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Wisconsin Wastewater Operators' Association

The Clarifier

WISCONSIN WASTEWATER OPERATORS' ASSOCIATION, INC.

Aerial view of Viroqua Wastewater, Viroqua, Wisconsin

54th Annual W.W.O.A. Conference

October 20-23, 2020
Kalahari Resort, Wisconsin Dells

Inside This Issue...

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.

2020 - 2021 W.W.O.A. OFFICIAL DIRECTORY

Presidents message: Unprecedented times

Greetings to my fellow wastewater colleagues! On these first days of spring we are likely all hoping for some dry, sunny weather. Snow melt and spring rains bring high flows to many of our treatment facilities as a result of inflow and infiltration to our collection systems. This can pose significant challenges to operations. Many of you are likely wearing your meteorologist hat as frequently as your operator hat this time of the year. Very saturated soils going into winter will certainly make the impact of spring rains more visible to our treatment plant flows.

In addition to ordinary spring high flow challenges, we are all dealing with a much more unique and significant event that none of us have ever experienced before. COVID 19 has certainly impacted us all and has created scenarios that challenge our traditional methods of thinking and operations. Terms such as social distancing have become part of our daily discussions. Many facilities are making significant adjustments to their staffing plans, allowing staff to work from home if possible, reducing operating crews, creating separation, minimizing exposure, and developing emergency operations plans to assure critical functions of the treatment facilities can remain in operation despite the pandemic. These unprecedented times have created unprecedented decisions such as cancellation of many gatherings and events. WWOA, like many other organizations has been faced with some difficult decisions to cancel all events until mid June. The WWOA Board of Directors will continue to monitor the situation and determine if events after that date will be safe to hold. As an organization, our top priority right now is to be certain we do not create a situation that would put operators' health and well-being at risk. As key staff operating critical infrastructure in each of our communities, there has never been a time more important than now to keep everyone healthy. Everyone should take great pride in their role working for a public health organization. The role every operator plays right now is just as critical to maintain public health as police, fire, and health care workers.

These challenging times are offering us all an opportunity to evaluate effective methods of communication. I'm certain many of you now rely much more heavily on email, phone calls, teleconferences, and video calls than you ever imagined. I would like to predict we will all come out of this pandemic situation with new skills that we never had before. Some of these skills may prove to be quite effective for the future. We need to remain strong, work together, and take all possible precautions to keep ourselves, our families, and our coworkers healthy. Your health is now critical to protecting our most valuable resource, water. Take time each day to focus on your wellness, both physical and mental. Seek the help from your employee assistance program or counselor if needed. Our communities are depending on us more now than ever before.

Despite the nation-wide pandemic and the situation we are all currently facing, the WWOA Board is continuing efforts to plan another great annual conference to be held this year at the Kalahari Resort in Wisconsin Dells October 20-23. Exhibitor registration is currently open, and registration will open for attendees by early summer. We hope you will be able to join us for the conference.

Best wishes, stay safe, and stay healthy,
Jeff Smudde

Remaining Clarifier Deadlines

June issue	May 15
Sept. issue	August 14
Dec. issue	November 13

City of Viroqua Utilities

by Sarah Grainger, City of Viroqua

City of Viroqua Clarifier Article - March 2020 The City of Viroqua is located on a ridge in the Western Upland area of Wisconsin also known as the "driftless" or "unglaciated" region. Viroqua is the largest city in Vernon County with a population of roughly 4,400, and as the county seat, Viroqua serves as the government center. Viroqua values and celebrates its agricultural history and long-standing community traditions. Known as a mecca for outdoor recreation, it has a strong locally grown and value-added food system and offers an abundance of diverse health care and education options.

Viroqua Utilities, managed and operated through a municipal enterprise fund, serves 2033 sewer customers. The collection system includes seven lift stations and 34 miles of sanitary sewer pipes ranging in size from 6 to 18 inches in diameter. The wastewater is treated by the City's 0.54 MGD wastewater treatment facility.

There are 8 employees that are responsible for managing and operating Viroqua Utilities. The wastewater treatment facility is operated by Al Budworth, lead operator, and Brok Eitsert, operator-in-training. They are supported by Greg Marsh, Utilities and Operations Superintendent, and Jason Hanson and Jared Rahr, Utility Auxiliary Workers, who focus on operating and maintaining the collection

Staff L to R: Greg Marsh, Jason Hanson, Cheryl Purvis, Brok Eitsert, Jared Rahr, Al Budworth, Sarah Grainger, Kathy Volden

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system and the Utility's water system. Finance and account management is provided by Cheryl Purvis, Utility Clerk, and Kathy Volden, Deputy Utility Clerk. The Utilities are managed by Sarah Grainger, Director of Public Works and City Engineer. This team continually strives to provide Utility customers optimal service while protecting the environment.

System History

The City of Viroqua wastewater treatment system has evolved through the City's history, from small filters in low areas of the City, to the original trickling filter secondary treatment plant built in the 1940s on the City's northwest side. In 1977-1978, the treatment system was moved to the existing site, northwest of the previous facility. The treatment system consisted of primary clarifiers and two CanTex activated sludge package plant trains. The trains, designated East and West, included aeration, reaeration, clarifiers, chlorine contact, and aerobic digestion contained in one circular basin. The treatment system site also contained a 670,000 gallon holding pond for flow equalization and sludge drying beds. The control building housed office and laboratory space, a chlorine room, a standby generator, aeration blowers, and a sludge pump.

1978 original treatment facility

In 1994, the facilities were upgraded to include a new anaerobic digester, sludge storage tank, leachate and septage receiving facilities and new aeration equipment. In 1999, the biological treatment process was modified to incorporate enhanced biological phosphorus removal (BPR) and back-up alum feed system to comply with new phosphorus limits. Additional modifications were made in 2002 including, addition of a digester supernatant tank, a mechanical screen (replacing influent comminutors), effluent UV treatment,

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fine bubble diffused aeration, a submersible nitrate recycle pump and new RAS/WAS pumps.

Springville Losing Stream

The Springville Branch of the Bad Axe River has been the receiving waterbody for all the iterations of Viroqua wastewater treatment system. In 2006, the Wisconsin Department of Natural Resources (WDNR) began what ended up being nearly a decade of conversations with Viroqua, about this intermittent tributary losing water to the ground. As a result, many studies were performed on this stretch of the intermittent stream. A 2007 Effluent Outfall Investigation prepared by Davy Engineering suggested that about 83% of the receiving stream flow is lost between the WWTF discharge point and the Springville Spring, 2 miles downstream. Additional studies, by the WDNR and by Town & Country Engineering in 2013, corroborated these findings, although thought that lost flow was believed to be considerably less than 83% on average.

While there was no doubt that the stream was losing most of the flow, figuring out how to address the problem was a major issue. In particular, it was determined that six separated sections along that stream could be losing flow to groundwater, each varying in length from 200 to 400 feet long. These losing areas are related to the Karst geology in the region. The City discussed many options with the WDNR including grouting the stream bed, treating effluent to drinking water quality standards and an outfall extension. Eventually, the WDNR mandated in the City's WPDES permit that the losing stream issue be resolved by installation of a pipeline extending past the identified fractured bedrock area.

As a part of a $9.93 million facility upgrade project, a $2 million outfall extension project was constructed in 2018. This included approximately 2 miles of 12 inch "force main" that flows by gravity to the outfall structure located upstream of the Springville Branch.

New outfall structure. Photo by Elise Juelich photography

The Need for a Major Upgrade

In 2015, Viroqua Utilities teamed with Town and County Engineering to complete a Facility Plan. This plan started with the need to resolve the losing stream issue but was also intended to review the wastewater treatment facility as a whole. The facility was facing three major issues. 1. Aging infrastructure and equipment, 2. Poor energy and treatment efficiency and 3. New regulatory compliance issues. Aging infrastructure was a major issue for the facility. While there were several upgrades that happened over the 40-year life of the facility, major components of the system were original, such as the final clarifiers. In fact, one of the clarifier's shaft sheared in 2016, causing the facility to operate with only one of the two treatment units for over a month. It was determined the cause of the shaft shear was extensive wear. In addition to equipment age, many of the buildings were out of compliance with current building code including classified space codes.

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Treatment and energy efficiency were clearly an issue at the facility. The positive displacement blowers were oversized and far less efficient then the new generations of blowers that were currently on the market. Operators' efforts to optimize the biological treatment process were limited by the controls and flexibility of the treatment system. At times, treatment efficiency was optimized to 0.1 mg/L of phosphorus in the effluent but was never able to be consistent or reliable.

New Aerzen Delta blowers.
Photo by Elise Juelich photography}

Regulatory compliance was another major issue identified. The WPDES permit required construction of an outfall pipeline and implementation of new more stringent phosphorus limits. In addition to the reduction of phosphorus limits state-wide, changing the outfall location and the amount of effluent in the receiving body resulted in further reduction of the City's phosphorus discharge limit. Internally performed Vulnerability Assessments of the facility also revealed that the practice of 24-hour facility access for waste haulers created a significant security issue because of how the facility was configured.

2017-2018 Facility Upgrade

Viroqua Utility commenced a $9.93 million upgrade to the wastewater treatment facility in 2017, with engineering from Town and Country Engineering. The City received multiple grants and principal forgiveness including $2.024 million from Rural Development, $650,000 from Clean Water Fund, and $15,500 from Focus on Energy; with the remaining funds coming in the form of low interest loans from Rural Development and the Clean Water Fund.

Two new buildings and two building additions were constructed. This included the construction of administration building that included a lab, office, meeting/break room and garage. The influent screening and primary clarifier building underwent modifications to isolate the screen from the primary clarifier area and improve the HVAC system to meet current building code. Changes were made to outfall and facility piping to address peak flow storage and system hydraulics. The equalization basin was also relined.

New administration building.
Photo by Elise Juelich Photography

The biological treatment units were significantly overhauled. Instead of having two independent parallel treatment systems, the tanks were reconfigured to create one treatment train with four selector basins and four aeration basins. The redesign allowed for operational flexibility to take tanks out of service to better match wastewater flows and loads increased energy efficiency, designated sludge pumps and improved SCADA controls. The goal was to provide enhanced biological phosphorus removal and allow the facility to consistently meet interim and future phosphorus limits. Everything in the treatment units were removed

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Rebuilt biological treatment units.
Photo by Elise Juelich Photography

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down to the existing concrete structures. The treatment cell walls were reconfigured and then the units were rebuilt with new final clarifiers and Sanitare diffusers. High efficiency Aerzen Delta blowers and more extensive aeration controls were also installed.

New Krofta dissolved air flotation of sludge thickening. Photo by Elise Juelich Photography

The sludge handling system saw significant changes. A Krofta dissolved air flotation system was installed, in the former lab building, for waste activated sludge thickening. New Penn Valley pumps were installed for sludge pumping with designated duties. Anaerobic digester pumps were upgraded, the boiler was rebuilt, and the gas specialties upgraded and relocated to an isolated building addition. A new gas flare was also constructed.

The hauled waste receiving station received a major overhaul. The site was relocated, new tankage was built and security fencing, video cameras and keyless entry touch screens were installed. The SCADA system and controls were completely revamped, updating the system and improving operational efficiency. A stream bank stabilization project was also constructed on the facility site that will be incorporated into the future water quality trading program.

Post Upgrades

After two years of construction and a year to readjust to a new and more flexible way of operating, the Viroqua wastewater facility is realizing huge improvements to operation. The Utility continues to work with Town and Country Engineering and is also working with Greg Paul, Op2Myz, to push the upgraded facility to its full potential. In the past year, the Utility was able to easily meet the City's Multi-Discharger Variance (MDV) interim phosphorus limit of 0.8 mg/L and has been below the goal of 0.2 mg/L nearly all year long, which reduces annual MDV payments. While the Utility is still working on optimizing the system and ensuring consistency in treatment, it appears the facility upgrades have provided the tools necessary to achieve these goals.

Renew Your *Membership*

If you haven't paid your membership dues yet, please do so ASAP!! You wouldn't want to miss out on all the exciting news that is in each issue of the Clarifier, now would you?

If you have questions on your membership number, renewal date, or want to pay your renewal, contact Caley Mutrie at c.mutrie@wwoa.org or call 414-908-4950 x104.

Troubleshooting Corner: Where is the race won for which bacteria compete?/What is a dual sludge?

By Ryan Hennessy of Midwest Contract Operations, rhennessy@mco-us.com

The term "dual sludge" is not a well-known of even an officially recognized technical term for describing the microbiology of an activated sludge system but occurs fairly often. The term's origin is from Dr. Michael Richard who has spent over 40 years analyzing mixed liquor samples from all over the world and was also instrumental in linking the traditional/ Eickelboom filament/organism names with their associated cause (s). As wastewater treatment process goals and treatment schematics have adopted to meet new limits there is an ever increasing number of significant areas in which competition for the bacteria that ultimately "win" may take place.

The traditional "starting line" and generally the most significant area in which competition of bacteria occurs is the first 10 minutes at the front end of the aeration basin. At this point all of the growth factors come into play with extra emphasis on concentration of readily available food (organic acids/volatile acids). The availability of the BOD (food) depends on the form in which it is in. A good analogy to think of to put this into perspective is the glycemic index often referenced in the food that we eat. For example oatmeal and more complex carbohydrates are taken up slowly in our digestive systems as it takes time for stomach enzymes to "break these down" into readily accessible food, while a beverage like "Kool-Aid" is high in sugar and is processed immediately. The major different forms of BOD include particulate BOD, soluble BOD, and soluble BOD as volatile acids/organic acids. Organic acids are readily available to be absorbed through the cell membrane of the bacteria while particulate BOD and larger "pieces" are adsorbed and broken down prior to absorption through the cell membrane (think of the bacteria cell membrane as a "filter"- soluble food goes through right away while other items are caught by the filter and broken down into soluble forms before becoming available).

In general, the higher the concentration of organic acids/ volatile acids available at the front end of the aeration

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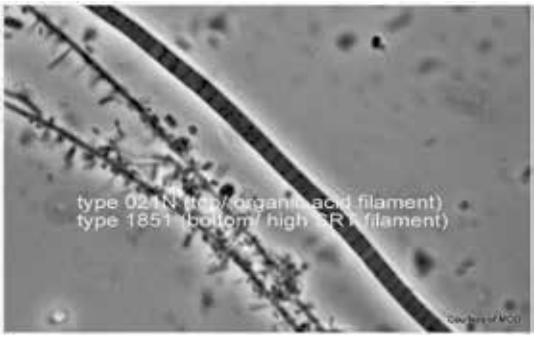
basin, the higher the oxygen uptake rate, bacterial growth rates, and initial depletion of BOD. Acetic acid is often oxidized and/or stored by bacteria within the first 15-30 minutes of treatment (Richard, 2019). When there is higher amounts of readily available food, bacteria that have the ability to oxidize and store food rapidly gain a competitive advantage. As an example, filamentous bulking from filaments that grow on organic acids generally occurs around a concentration of 100 mg/L of total volatile acids (Jenkins, 2004). Oxygen uptake rate is another major factor for competition at this stage. . At oxygen uptake rate (OUR) values of >60 mg/L/hr. at the front end of the aeration basin growth of dispersed single cell bacteria often occurs (Richard, 2018).



Side by side filaments-different causes

The % of readily available food (BOD as organic acids) is a major factor in the "eating habits" of the bacteria. Bacteria will oxidize/treat as much food as they can (there is a limit to how much they can "eat" in a "meal") with additional food stored for later consumption further down the aeration basin. This brings to light an interesting concept in that "1 lb. of BOD can actually be >1 lb. of BOD" in terms of overall oxygen amounts used per amount of food if it "isn't fully eaten in only one meal". (DO is utilized by the bacteria while storing food and then utilized again later for metabolizing stored food). Because of this, treatment plant available loading capacity may often be lower than the theoretically proposed loading capacity mathematics on paper when there is a high % of BOD as organic acids.

In anoxic/anaerobic selector processes the goal is to encourage the growth of mostly floc forming bacteria that have storage capabilities (such as polyphosphate accumulating organisms for enhanced biological phosphorus removal) in the selector zone and remove or store approximately 80% of the soluble BOD to help discourage the growth of many types of filamentous bacteria. The ORP (oxidation reduction potential) in

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the selector cell (s) is a significant indicator of selector performance. If a selector cell is overloaded (often occurs with ORP values <-350 mV) the amount of available food may surpass the storage capabilities of the bacteria and allow organic acids/ volatile acids to pass through into the aeration basin. If a selector cell is organically under-loaded there is a potential that after available oxygen electrons are depleted there may not be enough "food" to drive the ORP value low enough for storage to occur in bacteria that we are trying to "select" thus shifting reactions to fermentation/ generation of organic acids. In summary of this thought, selector performance in plants with these configurations is a precursor to what occurs in the first 10 minutes of the aeration basin.

The next major growth factor is the time in which food (BOD) is no longer available for consumption on the "back end" of the aeration basin. In the earlier growth stages bacteria spend their energy on creating new cell mass while in the later stages they spend more emphasis on "cell maintenance" through endogenous processes. If the time in which there is little to no available food for the bacteria becomes high enough on the "back end" the bacteria that have slower growth rates and lower endogenous demands tend to compete better. An example of some of these bacteria include high SRT (sludge retention time)/ low F/M filamentous bacteria.

Some plants such as oxidation ditches and extended aeration processes are specifically designed to encourage stability of treatment and promote endogenous activity to reduce sludge yield ("cannibalism" occurs when the bacteria run out of food). A common example for a "dual sludge" may be an oxidation ditch that treats a waste stream with a high % of BOD as organic acids. In the first 15 minutes to half hour of treatment much of the food is taken up by the bacteria (a major factor on which bacteria "win"); however the hydraulic retention time of water in a process like this may be 24 hours (as an example) providing a high amount of time that the bacteria are aerated with little to no food. Here is where the classic "dual sludge" condition may occur in that both ends of the treatment process become

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significant factors in competition for the microbiology of the plant.

Applying microscopy for "dual sludge systems" as a process control tool is still beneficial but must be done with accurate ranking/ judgment of abundance of various filaments and indicator organisms. Determining which bacteria/ filaments etc. are the "culprit" for the problem is needed (as well as true definition of if a "problem" is actually present). The "culprit" is the bacteria/indicator organism that has the most significant impact on the overall floc structure creating undesirable settling characteristics.

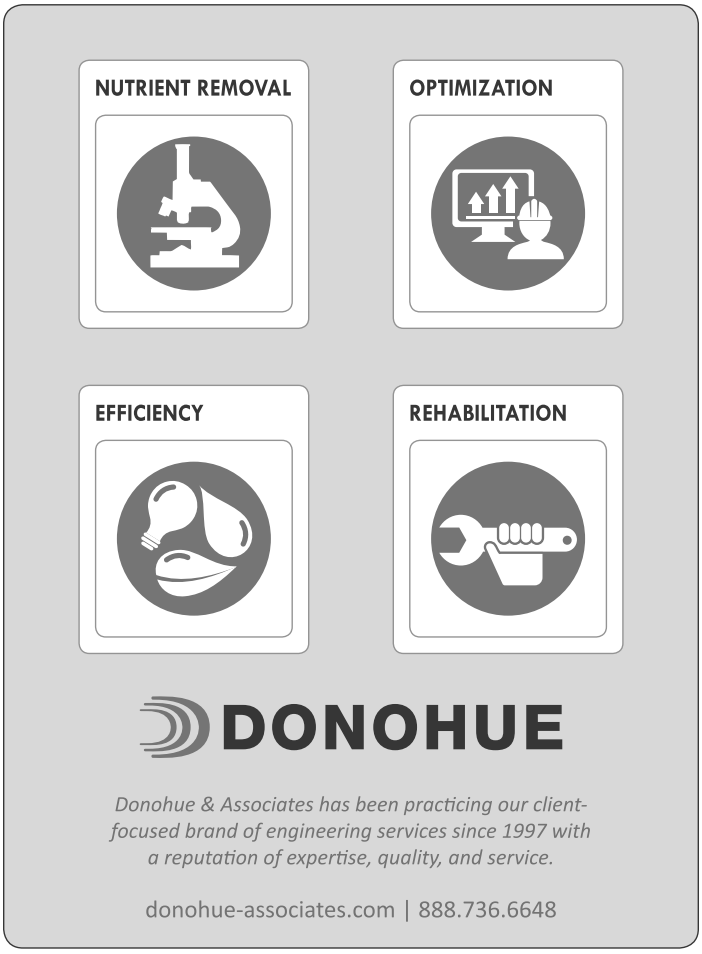
For example, if type 0041 and type 0675 (high SRT/low F/M filaments) have the biggest impact on the floc structure and there is high abundance of N. limicola (an organic acid filament/ "dual sludge situation") within the flocs that are not negatively impacting floc structure it may be desired to attempt to decrease the SVI by reducing the sludge age/ MLSS concentration.

Of note it always important to also consider the cause and effect any changes made to change the "back end" of the system may impact on the "front end".

For example, in the above scenario if the sludge age is decreased and type 0041 and type 0675 are discouraged there is potential that the F/M ratio may then be higher at the front end of the system changing the growth factors there (another reason why slow changes are typically recommended).

Lastly "dual sludge" systems change the way we evaluate F/M ratio as a whole. The F/M ratio may appear low on paper when taking into consideration the size of the aeration basin and the actual pounds of microorganisms in the system in some instances, but if there is a high amount of organic acids/readily available food, the actual F/M at the front end of the system may be very high.

A good way to envision this may be thinking of dividing the aeration basin into 3 sections with separate F/M values and looking at the overall F/M ratio as the average value.



Meistner Cheese hosts February Southern district meeting

WWOA Southern District Meeting 02/29/2020
Hosted by Meistner Cheese Company in Muscoda, WI
There were 77 people present with 13 of them being vendors.

Chair Randy Langer presents Scott Meister with a plaque for hosting February's Southern district meeting

Thank you to Strand Associates for sponsoring the meeting. Everyone was welcomed by the President of Meister Cheese Company, Scott Meister. He provided a brief history of their facility and an overview of cheese making operations. Cheese production began in 1916 by Joseph Meister and eventually led to the Muscoda facility in 1976. Scott discussed some of the equipment and processes necessary to treat facility wastewater including their anaerobic lagoon system, aerobic treatment system, and seepage cells.

The next speaker was Andrew Skog from MSA who discussed a water quality trading program for the City of Brodhead. This included describing what water quality trading is, why water trading should be considered, challenges they faced, and lessons learned from the Brodhead project. The project included installing urban best management practices and restoring streams, lakes, and wetlands. Andrew mentioned the importance of optimizing your facility as much as possible prior in order to reduce trading costs.

Dan McKeaton from Aquafix presenting on quaternary ammonium cation toxicity

The following speaker was Dan McKeaton from Aquafix. Dan discussed quaternary ammonium cation (QAC) toxicity in wastewater. QACs are commonly used as a disinfectant in food industries and can have negative effects on wastewater facilities. He provided methods for studying impacts of QACs, testing results, conclusions made, and future research ideas. Long term, recovery, oxygen uptake, and QAC neutralizer product testing were examples of steps taken to get a better understanding of their toxicity. He found that the lower biological diversity and MLSS a facility has, the more susceptible they are to toxicity. To prevent Quaternary ammonium cation toxicity, a facility should consider supplementing nitrogen, actively monitoring biomass, and work with upstream communication to prevent discharges.

The next topic was Industrial Pretreatment Strategies discussed by Mike Doyle from Evoqua Water Technologies. When running a pretreat program, it is important to reduce, reuse, recycle, and recover. When out of these options, it is time for treatment. One should consider all costs when deciding whether you want to pay a surcharge or treat different nutrients.

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Mike Doyle from Evoqua presents on industrial pretreatment.

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Some things to consider include capital costs, possible rate changes, maintenance, and sludge disposal. Mike also discussed advantages and disadvantages of different treatment options including biological treatment vs. mechanical treatment and anaerobic vs aerobic systems.

The next presentation was from Jason Knutson of the DNR. He focused on PFAS, explaining what they are, where they come from, and why they are a problem. The DNR plans to expand their monitoring to 44 rivers and are proposing an enforcement standard of 20ng/L FOA + PFOS. Their 2020 timeline includes rule drafting, advisory group meeting, preparation of proposed rule, solicitation of information from EIA, and draft EIA. Suggested actions include sampling of influent and effluent and source identification and reduction (develop plan to sample and work with sources to eliminate PFAS). Jason also explained that the DNR is working on expanding opportunities for trading. Jason stated that E. coli and enterococci are better pathogen indicator bacteria because they provide a better link between human illness and exposure to human fecal pollution. It is likely that facility permits reissued in the future will include limits based on these indicator organisms.

At 11:30, the Southern District business meeting started. The Treasurer's report was provided, and the 2020 operators competition was advertised with a $100 incentive for the top placing Southern Region Team. We are looking for a secretary for 2021. Josh Voigt provided the WWOA Board Member Update and focused on getting in votes for operator of the year and the scholarship opportunities available.

Patty Miller from the City of Beloit had the next presentation on their pretreatment program (past, present, and future). Their purpose is to protect the facility, sewer system, and all workers while keeping a good relationship with local industries. Their job duties include meeting all federal, state, and local program requirements and prepare annual/semi-annual IPP reports and CMOM report. She provided examples of working with industries and troubleshooting issues.

Next, Eric Wilgenbusch from Unison Solutions discussed biogas conditioning for industrial applications. They focus on H2S removal, gas compression, and removal of moisture, siloxanes, and VOC. He explained how they choose which type of equipment is used based off concentrations of h2s, siloxanes, methane, nitrogen, and oxygen (microturbine, boiler, etc.). The process of H2S and siloxane removal is important because high concentrations of either can degrade equipment, create a hard deposit on surfaces, and provide safety issues.

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Laboratory Limelight: The "Whys" behind wastewater testing (BOD, TSS, Ammonia, Total P)

By Rick Mealy, RGM Lab Consulting

Let's just get something out of the way right up front. I won't be explaining the "whys" behind thermometer calibration. I am not now, nor have I ever been an agent of the "thermometer police". While there is some rationale for re-certifying thermometers, the simple reality is that if the thermometer isn't broken or the column of liquid is not separated, a thermometer should work. I also happen to know a guy north of Green Bay who is pretty handy with a lighter and a thermometer. He can separate columns or re-join them. If the glass thermometer is broken, though, it's game over.

Now, when it comes to IR based thermometers—especially if you drop one—it might be a good thing to re-check the accuracy and make sure the IR has not been compromised. If you drop one hard enough, of course, the impact could affect the motherboard, and then it's in need of major help. Otherwise, I have listed some of the more common "why do I have to do this" questions (with answers) below:

Why do I have to calibrate daily?
Current NR 149 rules only require daily calibration for analyses (actually instruments) that can change considerably from day to day. The best example is ion-selective electrode (ISE) analysis, for things like pH and ammonia. The physical principle by which ISEs operate has temperature as the only variable. Therefore, ANY change in temperature affects electrode/probe response time and slope of the calibration. So, unless you have a state-of-the-art temperature-controlled lab that does not vary, calibrations can and do shift. For things like total phosphorus, there is no requirement to run a run a full calibration every day—only a requirement to VERIFY (with a single standard) that the calibration in use remains valid. This is to ensure that nothing like a suddenly poor performing bulb or spilled material on the instrument optics do not impact the accuracy of the calibration Note that current NR 149 rules only require that a full calibration be performed annually. And changes to NR 149, once they take affect will allow the use of a calibration for as long as the daily (single) verification standard meets acceptance criteria.

Why aren't pre-programmed curves allowed?
There are two main reasons for this. First, labs do not have access to the raw data used to produce the calibrations (we have tried, and the vendors refuse to release that data). If you do not have the calibration data, you are not able to reconstruct sample results from calibration all the way to reporting. All you see on the instrument is a concentration with no indication of how the concentration was obtained. Often, you can "see" the instrument response (e.g., absorbance), but there is no "key" to how absorbance is converted to concentration. It's proprietary. The second reason is that these magic linear regression equations (which is the black box here) are developed in perfectly pristine research labs by advanced degreed chemists using brand new instrumentation and perfectly prepared and validated standards and reagents. These are not realistic representation of testing in a wastewater lab.

Why is there a 200 mg residue maximum for TSS?
Studies have shown that residue amounts greater than 200 mg can result in bias during the drying process. The surface of the residue tends to dry first and can form what is called a "salt cap" that traps moisture underneath. This anomaly will lead to results biased high because more moisture SHOULD be dried off, but that is prevented.

Why do we even do the BOD test? It takes 5 days to get results and is more art than science.
It's a bit of a cop out, but it's the best we have at this point for determining the impact on stream oxygen levels when a waste is discharged. If you don't already know, you definitely do NOT want to know where the 5 days came from! If oxygen is utilized by the waste (effluent) being discharged, it can reduce available oxygen to other aquatic life. Most of us have encountered "winter kill" at ice out, when numerous dead fish float to the surface. This happens because oxygen in the water body was depleted by other things (such as degradation of weeds) over the winter. There are quicker tests (such as COD), but they do not accurately reflect oxygen utilization by microbes.

Why are there holding times? How are they derived?
Many analyses are subject to bacterial degradation or analytes breakdown for other reasons. The EPA has established a protocol for testing samples at Day 0 and then at time intervals looking for the point at which significant variability of results occurs or at which the original analyte concentration has been reduced by a specified percentage (typically 20%). This establishes hold times, which are subsequently made into federal law. There are certainly valid reasons to support holding times for some analyses. BOD, for example, is subject to bacterial degradation and even oxidation due to the sample composition. TSS is another

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one where unseen to the naked eye, microorganisms and chemical reactions are at work that can reduce the TSS content.

Even ammonia, while a stretch, can be subject to losses. Preserved samples are acidified which ensures the ammonia is in the ionized (NH4+) form. At pHs above 11, virtually all ammonia is converted to the gaseous form (NH3) and can volatilize. That's actually the principle behind ammonia electrodes. And, ammonia exists in a pH-dependent equilibrium between ionized and gaseous form. So, if your wastewater is at a higher than neutral pH…say 8.5… nearly 20% of ammonia is always in the gaseous form and can be lost, if it sits out before analysis, as soon as you take the sample lid off. Other tests, however, can leave one scratching their head. Take Total Phosphorus for instance. Phosphorus is an element. And elements cannot be destroyed. Can total P be broken down by bugs and converted to dissolved P? Sure. But the analysis we do is for TOTAL P, which means the entire sample is oxidized and all P is converted to dissolved P. So, this one that—arguably—makes little sense.

Holding times for solid materials just seem weird. You have a pile of solid material that has been where it is (subject to microbial and UV radiation) for some time, yet suddenly you take a sample of it and NOW it has a holding time attached.Sure, some holding times seem crazy, but there are those among us that feel that speed limits are crazy. I've been known to drive at a comfortable 4-5 mph over the highway speed limit, but I still see vehicles (hmmm, many with IL plates) fly by me.Nevertheless, laws are laws, and karma will catch up with the scofflaws. It doesn't seem to happen when you'd like it to, but remember: "Time won't help you, 'cause karma has no deadline."

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Lastly, Troy Larson from Strand Associates gave an overview of Meister Cheese Company WWTP. This included an overview of wastewater sources, a history of their treatment expansion, and an overview of their current operations. They have a lot of flexibility due to their treatment options of truck, seepage cell, ridge and furrow, and spray sites. In the last decade, they installed an activated sludge system and anaerobic lagoons. The lagoons produce methane which power the generators to produce heat and electricity.

Meister Cheese Facility Tour at 1600 Middle St. Muscoda, WI 53573.

Safety Article #2: Confined space & site rescue plans

Confined Spaces are an important hazard to be aware of on any jobsite. Confined spaces pose unique dangers, and often require specialized equipment in order to be protected. OSHA considers confined spaces, anywhere that "… are not necessarily designed for people, and are large enough for workers to enter and perform certain jobs. A confined space also has limited or restricted means for entry or exit and is not designed for continuous occupancy."

Some classic examples of confined spaces are tanks, vessels, silos, storage bins, hoppers, vaults, pits, manholes, tunnels, equipment housings, ductwork, and pipelines. Additionally, there can be areas designated as "permit-required confined spaces", which are especially hazardous and contain one or more of the following characteristics: contains or has the potential to contain a hazardous atmosphere; contains material that has the potential to engulf an entrant; has walls that converge inward or floors that slope downward and taper into a smaller area which could trap or asphyxiate an entrant; or contains any other recognized safety or health hazard, such as unguarded machinery, exposed live wires, or heat stress.

When planning to enter a confined space, safety personnel needs to ask 3 basic questions:

1. What could be inside the space that would pose a risk?
   - Toxic Atmosphere
   - Oxygen Deficiency or Enrichment
   - Contents and Residues
   - Flammable/Explosive Atmospheres
   - Flowing Liquids or Solids
   - Excessive Heat
   - Structure and Layout
   -

2. What will be created due to the work carried out in the space?
   - Ignition Sources
   - Flammable Substances
   -

3. What's outside the space that might pose a risk during the proposed work?
   - Inadequate Isolation
   - Inadvertent Operation of Plant
   - Nearby Work Activities

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One of the most important pieces of equipment that can rule out many of the problems above is a standard 4-gas monitor (Oxygen, Hydrogen Sulfide, Carbon Monoxide, LEL). A pump with tubing and a probe is a great way to sample the atmosphere to ensure its safety prior to entering any confined space.

It is also a good policy for every worker entering a confined space to wear their own monitor in order to be alarmed for any changes in atmosphere in their immediate area. As technology improves, gas monitors are available with features such as man down sensors, interconnectivity, and data-logging. Ask your safety supplier for information about gas monitoring equipment, bump testing, and calibrating in order to stay safe and compliant!

Fall protection is another key PPE component in confined spaces. Often, entering confined spaces requires workers to go into areas where a fall could be fatal. Places like manholes, tanks, and silos that are especially dangerous. Remember, OSHA requires some sort of fall protection (passive or active) if there is a fall potential of 48" or more. Tripod systems are the classic protection for manholes, as a 3-way SRL can be attached for fall arrest, winching to pull a worker out, or restraint to keep workers away from a ledge. When using a tripod or any fall protection equipment, all personnel must be trained not only to use the equipment, but also trained on the site rescue plan.

As with all things in life, nothing is guaranteed, and even when you do everything right, something can go wrong. Site rescue plans are a must have in case things do go wrong. Simply stated a site rescue plan lays out: emergency contacts, necessary rescue equipment, important rescue factors (such as potential obstructions), pre-work tasks (such as probing the atmosphere), and response procedure. Rescue plans can vary greatly based on the task at hand, the hazards involved, the location of the work, etc.

The main point is to go over all potential hazards and have a plan that is enacted immediately when things go wrong, because when they do, every second counts! Simply put, if

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your plan is to simply call the local fire department, you are already behind the eight ball. There are many resources available to you for free online from OSHA, and fall protection manufacturers. If you need help assessing a job and developing a plan, please reach out to your safety supplier and if they don't have the answers they can get you in touch with someone who does!

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