45th Annual W.W.O.A. Conference
October 4-7, 2011 LaCrosse, WI
LaCrosse Convention Center
Holman Wastewater Treatment Facility – Host
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.
President’s Message for February 2011: Training Opportunities

President, Dave Carlson

The holidays are over and we look for spring and warmer days. With the weather being extremely cold, in Fond du Lac we have hundreds of ducks that make our final clarifiers their home for about three months. When we check the clarifiers the ducks fly off and create a strong breeze with their wings. It’s nice to have them as visitors but they sure make a mess to clean up in the spring,

Everyone is excited about the Packers making it to the Super Bowl. Only two weeks for the big game. There is a lot of press for Green Bay and the State of Wisconsin. It’s going to be a tough game but if they play on Super Bowl Sunday like they have in the playoffs, the Green Bay Packers should be the Champions. Go Pack Go!

The month of February is loaded with training opportunities. Regional meetings scheduled for February are as follows: North Central – Wausau on February 1st, Southern- Wisconsin Dells on February 8th, Lake Michigan- New Holstein on February 17th, and Southeast-WalCoMet on February 23rd. The Southern Meeting is in conjunction with the Midwest Water Expo and is at the Kalahari Resort again this year.

Other training opportunities are the Government Affairs seminar on February 24th in Middleton. Presentations will cover the new Phosphorus Rule, the Thermal Rule, Air Permitting and the Sanitary Sewer Overflow Rule. Scheduled on March 22nd is the Spring Bio-Solids Symposium that will be held at the Holiday Inn in Stevens Point.

Remember to go to the WWOA Website at www.wwoa.org to get more information on these and other training sessions that are being offered.

The Wisconsin Department of Workforce Development has received a grant from the Federal Government to develop an apprenticeship program for the occupation of wastewater operator. WWOA Directors Kevin Freber and Kelly Zimmer have been participating in developing the program. This apprenticeship program will coincide with upcoming changes to the Wastewater Operation Certification Program being considered by the WDNR.

Regarding career development, the WWOA will be attending the Wisconsin School Counselors Association Conference in February at Stevens Point. WWOA Director Lyle Lutz and I will represent the WWOA displaying a booth and presenting information to the states guidance counselors to generate interest in our profession.

Wade Peterson, 2011 Technical Program Committee Chair, has been working on preparing for the 2011 Annual Conference to be held in La Crosse. Wade has assembled a committee of about 20 people who will meet on February 15th to review the papers received and select the best topics and presentations for our conference this year.

Wade is also exploring various options for the keynote address speaker and the entertainment after the banquet.

It’s never too early to start planning for the 2011 Operators Challenge. Regions, please begin to assemble your teams early for this years competition. Kevin Freber is the WWOA Operators Challenge Committee Chair. Randy Thater, WWOA President Elect is the 2011 WWOA Annual Awards Chair. Please consider nominating a deserving person to be recognized for their outstanding work and dedication to our field.

Until next time,
all the best to you….

Dave Carlson,
WWOA President
Walworth County Metropolitan Sewerage District 2009 Plant Expansion


In 1967, a conscientious property owner plunged into the algae-filled waters of Delavan Lake to draw attention to the widespread pollution afflicting his beloved lake. His dramatic actions captured the attention of his neighbor and prompted a cleaning crusade which, in 1970, culminated with the establishment of the Delavan Lake Sanitary District (DLSD).

Efforts to obtain funding for the DLSD sewerage system drew the interest of the Southern Wisconsin Planning Commission and precipitated consideration of a regional plant which could efficiently serve the surrounding communities. In 1974, following a series of studies and hearings, the WDNR ordered the creation of the Walworth County Metropolitan Sewerage District (WalCoMet).

The new regional Sewerage District was formed to serve the Delavan Lake Sanitary District, the cities of Delavan and Elkhorn, and Walworth County Institutions, thereby eliminating the duplicated treatment efforts of each of these entities. These efforts represent a four-year process which today has resulted in the WalCoMet wastewater facility, an example of the benefit of municipal cooperation, coupled with enlightened state and federal assistance.

Since startup of the original facility the District has added 7 additional entities for a total of 11 that include the following:

- Lake Como Sanitary District No. 1
- Village of Darien
- City of Delavan
- Delavan Lake Sanitary District
- City of Elkhorn
- Geneva National Sanitary District
- Village of William Bay
- Inspiration Ministries
  - (Town of Walworth Utility District No. 1)
- Walworth County Institutions
- Pioneer Estates Mobile Home Park
- Town of Darien Utility District No. 1
- Mallard Ridge Sanitary Landfill

The WalCoMet service area is 16 square miles with a current population of over 28,000. The collection system includes 10 lift stations, 31 miles of force main, and 7 miles of gravity sewer. Flow from the 11 entities is measured and sampled at lift stations. 

continued on page 5
The plant was originally designed in 1981 for an average flow of 3.75 mgd with primary treatment, a two-stage nitrification process including fixed film bio-towers and activated sludge followed by tertiary filtration and chlorine gas disinfection. Solids handling included gravity sludge thickening, anaerobic digestion, and liquid sludge storage with land application. The plant was expanded in 1995 to 5.75 mgd with the same processes.

In 2006, Donohue was retained to update the previous 10-year facilities plan for a 20-year period to the year 2028. The new plan was to become Phase II of the previous plan. The goals of the Phase II facilities plan were as follows:

- Control odors
- Improve hydraulics to meet flow requirements for the planning period
- Improve preliminary treatment
- Rehabilitate the existing sand filtration system
- Replace the existing chlorine gas disinfection system with a safe system
- Upgrade other facilities including: anaerobic digestion, sludge thickening, laboratory, electrical, SCADA and personnel areas
- Control construction cost

As the facility plan progressed, projections for District population growth and sewer rehabilitation to control infiltration/inflow (I/I) dictated that the District should again approach plant expansion in two 10-year periods: 2018 and 2028. The first period to year 2018 was to be designed as Phase II of the previous facilities plan and include the 2009 facility expansion. The table below shows the flow and loading conditions at the current and two planning periods.

<table>
<thead>
<tr>
<th>Flow &amp; Loading Condition</th>
<th>Current</th>
<th>Year 2018</th>
<th>Year 2028</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permanent Population</td>
<td>28,371</td>
<td>46,553</td>
<td>61,177</td>
</tr>
<tr>
<td>Total Population (Including Seasonal)</td>
<td>39,140</td>
<td>60,037</td>
<td>76,797</td>
</tr>
<tr>
<td>Average Annual Flow</td>
<td>4.00 mgd</td>
<td>7.00 mgd</td>
<td>9.20 mgd</td>
</tr>
<tr>
<td>Maximum Monthly Flow</td>
<td>5.53 mgd</td>
<td>9.57 mgd</td>
<td>12.7 mgd</td>
</tr>
<tr>
<td>Maximum Weekly Flow</td>
<td>7.57 mgd</td>
<td>13.1 mgd</td>
<td>17.3 mgd</td>
</tr>
<tr>
<td>Maximum Daily Flow</td>
<td>14.0 mgd</td>
<td>20.2 mgd</td>
<td>25.2 mgd</td>
</tr>
<tr>
<td>Peak Hourly Flow</td>
<td>18.7 mgd</td>
<td>26.6 mgd</td>
<td>32.5 mgd</td>
</tr>
<tr>
<td>Peak Instantaneous Flow</td>
<td>20.0 mgd</td>
<td>28.3 mgd</td>
<td>34.6 mgd</td>
</tr>
<tr>
<td>Average Annual BOD5 Loading</td>
<td>6,340 lb/d</td>
<td>9,900 lb/d</td>
<td>12,800 lb/d</td>
</tr>
</tbody>
</table>

The effluent limits for the Phase II planning period to year 2018 are as follows:

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD</td>
<td>10 mg/l Summer, 14 mg/l Winter</td>
</tr>
<tr>
<td>Suspended Solids</td>
<td>10 mg/l Summer, 14 mg/l Winter</td>
</tr>
<tr>
<td>Ammonia</td>
<td>8.2 mg/l Daily</td>
</tr>
<tr>
<td>Phosphorous</td>
<td>1.0 mg/l Monthly Average</td>
</tr>
<tr>
<td>Dissolved Oxygen</td>
<td>7.4 mg/l Daily Minimum</td>
</tr>
</tbody>
</table>

The 2009 facility expansion met the needs of the facilities plan by increasing plant hydraulic capacity, eliminating odors and rehabilitating or replacing aging system components within the $20.5 million budget. The improvements were completed throughout the plant, requiring coordination with the contractor and plant operations.

Odor control was added to the preliminary and primary treatment facilities. These odors were controlled by...
installing removable covers on the preliminary treatment channels and primary clarifiers, and removing the odorous air to an in-ground bio-filter. The bio-filter contains engineered media for efficient odor control in a small footprint. The odorous air is distributed below the media in a plenum and then discharged at the top. No odor complaints have occurred since the system was started up. The grit removal classifier was upgraded to clean the grit. The unit cleans the grit to remove odorous organics followed by drying the grit before disposal in the landfill. The plant previously did not have raw wastewater screening, allowing ragging material to clog pumps, causing the failure of the primary clarifier mechanisms, and allowing non-digestible material to pass into the digested sludge system and onto the land. Two 1/8-inch opening step screens with washer/compactors were added to the preliminary treatment facilities. The screens now remove the deleterious material and have improved digested sludge quality and decreased pumping and primary clarifier mechanism problems.

During facilities planning, the bio-towers were to be rehabilitated with new media and motorized distributors. After a value engineering study of the facilities plan, it was determined that the existing activated sludge aeration system was adequate to provide nitrification through the first planning period, deferring the bio-tower rehabilitation and saving over $1 million.

Two new final clarifiers with associated return sludge pumping equipment were added to the existing group of three for a total of five final clarifiers. The existing activated sludge process was converted to a single stage nitrification system and retrofitted with mixed liquor flow control to three aeration tanks and then split equally to the five final clarifiers. The aeration basins were upgraded from ceramic to membrane fine bubble diffusers and dissolved oxygen control.

continued on page 7
The tertiary sand filtration system is sized for a peak flow capacity of 19 mgd with one filter out of service. The filter feed pumps have a firm capacity of 13.6 mgd. The water quality of the secondary effluent was evaluated, and it was determined that a portion of the secondary effluent could be blended with the tertiary effluent at peak flows and meet water quality standards.

As a result, no additional filtration capacity was needed; however, the 1981 filters were upgraded with new controls and valves. The filter media was changed and the underdrain system received an inspection and cleaning, and the backwash pumps were rehabilitated.

The existing chlorine gas disinfection system was changed to Ultraviolet Light (UV) for improved safety. A self-cleaning system was added with water level control for the UV provided by fixed weirs. The effluent is aerated and discharged to Turtle Creek.

The waste activated sludge was co-settled in the primary clarifier process and thickened in the gravity thickener. Co-settling deteriorates primary clarifier capacity. To improve primary clarifier performance and defer building costly primary tanks, the waste activated sludge is thickened in a rotary drum and pumped directly to the anaerobic digesters. An abandoned primary clarifier from 1981 was modified for waste activated sludge holding, with the addition of a building to house the rotary drum and thickened sludge pumps.

With this modification, the primary and secondary waste solids concentration is constantly above 5 percent to the continued on page 8
continued from page 7

The impact is improved anaerobic digestion through greater hydraulic detention time and improved side stream water quality by replacing the gravity thickener.

The three 45-foot diameter anaerobic digester gas mixing systems were replaced with mechanical nozzle mixing systems to improve digestion. The digester covers were removed from the tanks, cleaned, inspected, rehabilitated, painted and reinstalled. Gas handling improvements were made to meet safety code requirements.

The digested sludge storage pump and liquid digested sludge truck loading facilities were upgraded. The upgrade allowed the truck loading facilities to be efficiently used for improved sludge handling.

The electrical switchgear was replaced due to age. Also the SCADA system was upgraded to the latest version of the Human Machine Interface (HMI) and expanded to the new facilities.

The laboratory was doubled in size and fully remodeled to accommodate the testing of the entity’s wastewater and plant performance. The layout of the laboratory was completed by the plant staff for efficient use of space and future work.

Personnel areas were expanded and remodeled. A new training center was built that is also used as a lunch room. The abandoned chemical feed room was remodeled into a men’s locker/shower facility and the existing men’s locker/shower facility was remodeled for a women’s facility.

Most of the site was touched by the 2009 facility expansion including the tunnels and equipment rooms. The project was completed under budget at just under $20.5 million. Water quality throughout the project was met, through the excellent cooperation and communication between the contractor and the District.

WalCoMet is moving ahead to help the entities remove the excess I/I in their system through a cooperative planning and public relations effort. The goal is to reduce the I/I to defer the 2028 expansion beyond the target date.
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IN CONTROL – Curl Up and Settle Down With Your Sludge Blanket
February 2011

By Amy Schmidt, Wastewater Engineer, Department of Natural Resources

Typically, most operators run a 30-minute settling test and write down the settled volume of the sludge at the end of 30 minutes; however, this value does not supply settling characteristics of the sludge to the operator. How well is the sludge settling? Is the sludge age appropriate? Are there too many filamentous organisms present? Are there too many MLSS in the aeration basin? What helps answer these questions is to create a settling curve from the 30-minute settling test.

When running this test, you should record the settled sludge volume every 5 minutes for 30 minutes and then once more at 45 and 60 minutes. If operators record these volumes, they can then create the graph. These settling curves are instructive tools on how the sludge is settling and can help with troubleshooting problems.

This graph shows a good settling sludge, indicative of good floc forming bacteria and low numbers of filamentous organisms. The environmental conditions that exist within this plant should be maintained.

The second graph shows a poor settling sludge. Poor settling can be caused by excessive filamentous organisms, slime bulking, or too many solids within the system (hindered settling). To differ between excessive filamentous organisms and hindered settling, a diluted 30-minute settling test can be performed. If the curve improves, there are too many solids and wasting should be increased. If the curve does not improve, filamentous organisms are likely to blame. They need to be microscopically identified and the environmental conditions that contribute to filament growth should be altered accordingly.

The third graph shows sludge that “settles like a rock.” Sludge that is this fast settling is usually an old sludge age and appears grainy. Since old sludge age is the likely problem, wasting rates need to be increased in order to increase the F/M ratio and decrease the sludge age.

In order to benefit the most from the curves, it is best to run the 30-minute settling test with each MLSS analysis. Generate the graphs at least once a week. Please contact me (amy.schmidt@wisconsin.gov) or Jack Saltes (jack.saltes@wisconsin.gov) for the Excel spreadsheet for easy curve generation.
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Jon Schellpfeffer Retires after 36 years of service to Madison Met

By Matt Allen  MMSD

Jon Schellpfeffer, Madison Metropolitan Sewerage District’s (MMSD) Chief Engineer and Director, is retiring after 36 years of service. Jon began working at MMSD during November 1974 as the Operations Engineer. Over the years, Jon served as the Operations Engineer, Director of Engineering, Assistant Chief Engineer and Director of Planning, and since 2002 as the District’s Chief Engineer and Director.

During the 1970s and early 1980s Jon developed the District’s User Charge program and billing system. His work in this area resulted in his recognition as an expert in the field of service rate development. During this time, Jon also developed the District’s Sewer Use Ordinance and worked with all of the District’s municipal customers to help them to develop similar ordinances to protect their systems as well as the District’s collection system and treatment plant. Since the mid-1970s, Jon has worked closely with the Department of Natural Resources grants and loan programs to obtain the financing to construct multi-million dollar additions to the treatment plant and collection system. Jon has been involved in the last six of eleven additions to the plant. The combined value of the assets for these additions is in excess of 100 million dollars.

Jon has also worked closely with the Dane County Regional Planning Commission on long range studies for interceptor expansions. As Director of Planning, Jon has prepared annual budgets for capital improvements. This long-term planning effort allowed the District to prepare for future expenses and set user rates accordingly. This has resulted in the District’s strong financial position for many years. With the implementation of a computerized maintenance management system in the mid-1990’s, Jon completely restructured the District’s chart of accounts to allow for more accurate and transparent accounting of expenses. He also assumed management of the Administrative Services section, the Information Technology section, and the Training area at that time.

Jon shared his financial expertise with others in the profession. He served for over 30 years with the National continued on page 14
Fieldbus

A modular approach to Fieldbus physical layer components from Phoenix Contact provides infrastructure connection between the process Fieldbus controller and field devices. This new concept combines industrial electronic packaging and data communications competencies to deliver high-value Fieldbus infrastructure solution.

nanoLine

nanoLine is a small programmable controller/relay with unique features such as Ethernet connectivity, removable operator display and easy flow-chart or RRL programming. The modular design allows for connections of up to 3 I/O expansion modules (RS 232, RS485, USB). It allows for easy data exchange with Modbus TCP or Modbus RTU master devices.

Managed Ethernet Switch

Economical managed Ethernet switch supporting SNMP, RSTP, Web Based Management capability are standard features. This Switch supports applications where Multicast traffic is a concern (like Ethernet I/P), a “-E” version is available with default enabled IGMP Snooping.

SFN Switch

The SFN family of unmanaged Ethernet switches provide low cost, fully industrially hardened, entry-level switch functions with 5 or 8 ports (10/100 Mbps) in a narrow housing width. Complete range of 100 Mbps glass fiber configurations to support 1 or 2 ports with SC or ST style connectors. The new SFNT group of Ethernet switches are for applications where extreme temperature conditions (-40C to 75C) exist.

Ethernet Modem

The Ethernet modem makes remote servicing and diagnostics of distant ethernet network devices as simple as dialing into an Internet connection. Ethernet control systems and operation panels anywhere in the world can be controlled remotely via a modem and a telephone line.

UT Terminal Blocks

UT screw connection terminal blocks are designed in a compact profile for easy, maintenance-free handling. UT terminal blocks have a dual bridging channel for power distribution (chain, skip, step-down). Manufactured with nickel and tin plated copper alloy components to protect against corrosion and eliminate thermal expansion issues.

IEEE 802.11 WLAN radios are ideal for high speed data networks. The high power variant of the product family provides the extra power needed in long range application while maintaining the highest levels of security and can easily form into Mesh networks. The WLAN technology opens the door to many different bandwidth intensive applications such as video surveillance, remote monitoring and control and mobile networking.

GSM GPRS Modem

The GSM GPRS Modem is ideal for remote monitoring of alarm contact and data acquisition. The GSM GPRS modem is approved to be used on AT&T network and can easily interface with RS232 serial connections or can be used standalone to monitor digital alarm contacts. Phoenix Contact has partnered with Diversenet to allow for easy activation of the modem’s SIM card on the GSM GPRS cellular network.

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www.aa-electric.com
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Association of Clean Water Agencies (NACWA), formerly the Association of Metropolitan Sewerage Agencies. Jon was the primary author of the 1990 and 1993 national Financial Survey for this organization. He also gathered data and produced the NACWA Financial Index on an annual basis from 1992 through 2002. In addition to being a member of the organization’s Board of Directors, Jon received the organization’s President’s Award in 1994 and the Special Recognition Award in 2000. Since becoming the District’s Chief Engineer and Director, Jon has overseen several treatment plant expansions, numerous collection system upgrades, the District’s 50 year Master Planning effort, the District’s responses to increasingly stringent phosphorus limits.

Jon has always supported personal and professional development of MMSD employees. He has encouraged and supported membership and active participation in WWOA. Most recently, Jon has worked on the development of Leadership Expectations for District staff. All the people who have worked with or for Jon join together in thanking him for his service to public health, the environment, and the industry. We wish him well in retirement!

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Madison MSD Commission Selects Chief Engineer & Director

The Madison Metropolitan Sewerage District Commission would like to announce that Michael Mucha has been selected as the District’s Chief Engineer and Director. Mr. Mucha will be replacing Jon Schellpfeffer as he retires.

Michael has over 19 years of executive leadership experience in city government, with appointments in Wisconsin, Pennsylvania, and has most recently served as the Director of Public Works for the City of Olympia in the State of Washington.

Michael is a registered professional engineer in Wisconsin, Pennsylvania, and Washington State. He also serves on the faculty of Evergreen State College and teaches graduate level management courses on topics such as sustainable leadership and transforming local government.

“Building a Relationship of Trust and Respect’ These seven words best describe what motivates Michael to get up and go to work every day. He believes the key to trust is finding balance in everything and developing a capacity to care about people. His passion is local government, where the work is closest to where citizens experience its value.

Michael has a Bachelor of Science degree in Civil Engineering from the University of Wisconsin and his Master’s in Public Administration from the University of Washington.

Mr. Mucha is expected to join the District staff during January.
For years sand has been used as a means of polishing effluent to tertiary standards. Sand media filters have high energy requirements because of large headlosses in the filter media and require significant precious space in a facility. Taking care of and servicing a sand filter can be a messy and time consuming undertaking.

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The wastewater to be treated flows through the segments from inside to outside and the filtrate is discharged over a weir. The spray bar is simple and easy to access. This design allows for uninterrupted filtration even while the screen is cleaning.

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Nitrogen, a Coffin, Shaving Cream and a Prayer

By Harry Mathos, Beloit Water Pollution Control Facility

The City of Beloit Water Pollution Control Facility (WPCF) was faced with what appeared to staff as a less than desirable project to undertake. Necessary yes but undesirable nonetheless. While any project that involves both a confined space and methane appears fraught with danger, the staff also had to deal with one more unsettling fact: the repairs were being made during the height of the Deepwater Horizon disaster which, reports indicated, was caused by the ignition of a “methane bubble”. Oh boy.

First however, a little background. The City of Beloit WPCF is an 11.3 MGD advanced activated sludge facility that employs a pair of fixed cover anaerobic digesters for solids stabilization prior to land application. The staff has historically run both digesters in parallel. Methane gas is drawn off both digesters using a common header with strategically placed valves to optimize flexibility. However, as we all know, strategic placement is good only when the equipment is working properly.

In the fall of 2008 WPCF staff noticed staining on an upper section of #2 digester’s exterior wall and odd fluctuations in digester gas pressure. We realized we had lost the seal between the roof and the sidewall – now what are we going to do to fix it? Obviously we would need to isolate the digester, drain, clean and make repairs. No problem, right?

Go ahead and laugh . . . I’ll give you a moment. The first step was to stop feeding the leaking digester and continue to dewater its contents as we normally would. Once we dewatered and stored a majority of its contents we would open the unit and have the remaining biosolids removed by a contractor. This, of course, assumes that the digester gas header valves are seating properly.

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continued from page 16
Once we opened the digester we realized that the roof leak is the least of our problems. It became obvious in short order that the isolation valve was not seating properly and allowing methane to seep back into the off-line digester. Why wasn’t the valve seating properly? Take a look at a picture of the valves.

OK . . . no problem. As you can see by the photo above there was another valve in the middle that we could use in an attempt to isolate.

NOTE: The photo above is after the project was complete. I failed to take “before” pictures and photos as we worked.

This was a valuable lesson learned: ALWAYS TAKE PICTURES!
continued on page 18
Because we know Murphy works at every wastewater facility in the world it was foolish to assume that the middle valve would seat any better than the other. It didn’t and neither did the isolation valve for the other digester. All three valves are corroded to the point where they are no longer functional or, in technical wastewater terms, frikin’ useless.

After brainstorming with staff it was decided to replace all three valves in one fell swoop while keeping #1 digester on-line and productive and, above all, to do it safely. First, two important questions needed answers - how do we isolate the header from the live digester, purge it of methane and prevent methane from continuously re-filling the line while we work and what is the safest way to complete the project with minimal disruption to the live digester and overall process control?

We figured it would take four to six hours to complete – that sounds like a long time when dealing with potentially explosive conditions. After a bit more brainstorming, operations and maintenance staff came up with a novel approach that included these three necessities:

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shaving cream, nitrogen and a prayer. The nitrogen would be used to purge the methane header prior to valve replacement. The shaving cream will be used prevent methane from the live digester to infiltrate the header as we work. The prayer was used as comic relief.

It was decided that the first step would be to stop feed to the live digester for twenty-four hours. We wanted to let the digester “rest” a bit before opening. The area was cordoned off with caution tape and “NO SMOKING” signs posted in strategic areas.

We set up the nitrogen tanks in the gas mix compressor room to back-feed the inert gas into the header and both digesters. On each end of the header were level indicator pressure compensation fittings which we used to both monitor the LEL of the header and add shaving cream.

Once we had staff staged, we removed the PRV weights from the live digester and allowed it to reach equilibrium. We then began to back-feed the nitrogen until we fed enough that would theoretically fill the entire gas system. We were off just a bit off but had a few extra tanks, just in case.

Once the gas monitors indicated 0 PPM LEL it was time to add the secret weapon: foamy menthol shaving cream. The gas monitors were removed from the fittings and shaving cream was injected into the pipe.

There was about a foot-and-a-half of header between the fitting and the digester wall penetration. We figured that would provide enough volume to “seal” the pipe. With non-sparking tools in hand we dropped the first valve and opened the pipe so we could again monitor for LEL. From there it was biff-bam-boom – no breaks – no chit chat – just focus on the task at hand and git ’er done.

I am happy to say that the shaving cream seal worked, the project was completed without incident and was a great exercise in teamwork. Even though the guys knew they’d be working in what we call The Coffin (see photo on next page) in a potentially dangerous environment, and coming on the heels of a methane-fueled national

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disaster, they still put their trepidation aside and took care of business. My hat truly goes off to them.

For the record, the staff that took care of business is: Tim Cunningham, Dave Hebb, Al Hocking, John Siam, and Wayne Steurer. This project illustrates what a little planning and a lot of hard work will accomplish. Good work gentlemen!

Help Wanted
Green Bay MSD

The Green Bay Metropolitan Sewerage District is accepting applications for the position of Director of Operations.

Interested applicants may review the job description and submit an application through the web site at: gbmsd.org or contact
Judi Christ – Human Resources Manager
by email at: judi.christ@gbmsd.org or
mail at:
Green Bay Metropolitan Sewerage District,
2231 N. Quincy St.
Green Bay WI 54302
Automatic Sludge Age Control – Waste Pounds Instead of Gallons

By: Bob Dabkowski, Wastewater Specialist, Licensed Colorado Wastewater Operator

With the increased sophistication and complexity in today’s wastewater treatment systems, from automatic aeration control to advanced nutrient removal, why is it still common to control the biomass with traditional wasting methods? Why not control the biomass in real time, and be able to respond quickly to subtle changes in the treatment system?

It was with these questions in mind that a pilot study was designed to automate Sludge Age control at the Morrison Wastewater Treatment Plant in Morrison, Colorado.

Mike Kehoe is the operator of the 100,000 gallon per day extended aeration activated sludge plant which serves the town of Morrison, CO. In addition to making clean water, he’s also responsible for maintenance and collections, and is “on call” for any needs at the drinking water plant.

To automate Sludge Age at his facility required two suspended solids sensors, a magnetic flow meter on the waste activated sludge (WAS) line, a Programmable Logic Controller (PLC) and a Human/Machine Interface (HMI). The only items not already existing at his plant were the two suspended solids sensors—one installed in the aeration basin to measure the mixed liquor concentration, and another installed in the waste activated sludge pipe to measure the WAS concentration in real time.

Both sensors were connected to one controller, and the analog 4-20mA signals were run from the controller to the existing PLC. An additional 4-20mA analog output was run from the existing magnetic flowmeter back to the PLC as well.

These signals were integrated into a real time control system, where Mike could enter a desired sludge age (in days) into his HMI, and the controller would calculate the pounds of waste activated sludge needed to achieve that sludge age based upon the 24 hour average mixed liquor concentration.

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When wasting began, the controller would poll the suspended solids concentration and flow during a set time, instantly calculating the pounds of sludge wasted. The pounds wasted in each event totalized, until the setpoint was reached. The wasting would cease for the day, having now achieved the desired sludge age.

Mike continued to calculate his solids inventory with their traditional method—spinning a centrifuge tube of mixed liquor to determine solids concentration by volume. He would then calculate the number of Sludge Units necessary to waste to achieve his desired sludge age. Comparing this information with solids concentration by weight can prove difficult as interferences exist which can inhibit sludge compaction or filtration.

However, when the data were compared, the results spoke for themselves—automatic sludge age control is reliable. Once in automatic mode, the only upsets were caused by electrical and mechanical failures (such as losing power at the plant and pump failure). When that happened the system reverted to fail safe mode and ceased wasting. After the failure was rectified the system operated as designed and returned to the desired setpoint.

As wastewater plants become more sophisticated, it is comforting to know that there are reliable tools available to ensure optimal operation. Automatic Sludge Age Control is one of these tools which lies at the heart of every wastewater plant and can improve performance.

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**Rick Weikel’s Correct Email Address**

In the December issue of the Clarifier, Rick Weikel, West Central WWOA Secretary/Treasurer’s email address was incorrect.

Rick Weikel’s correct contact information is:
Rick Weikel, Black River Falls WWTP
119 North Water Street
Black River Falls WI 54615
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UV Light – A Brighter Disinfection Alternative

Rob Jansen, Trojan Technologies, Kenny Khoo, Trojan Technologies, Regan Thompson, Trojan Technologies

History of UV

The use of ultraviolet (UV) light to disinfect water is not a new concept. The first UV water disinfection application was in 1910 in Marseilles, France. Since then, through many decades of research and development, UV disinfection technology has seen significant advances in the types of water that can be treated, the operation and maintenance of the UV equipment, and the overall cost effectiveness of a UV system.

As a result, approximately 25% of the wastewater treatment plants in North America currently use UV for disinfection. Although UV’s primary use in North America has been for wastewater, many drinking water facilities are also installing UV in order to meet the USEPA’s Long Term 2 Enhanced Surface Water Treatment Rule to protect water supplies from Cryptosporidium, a chlorine-resistant organism that is easily treated with low doses of UV. In fact, the world’s largest UV installation is currently under construction for New York City and will be able to treat 2,200 Million Gallons a Day (MGD) (Figure 1).

Non-chemical Approach to Disinfection

Ultraviolet (UV) light is a form of light that is invisible to the human eye. UV light at wavelengths between 200 and 300 nanometers (billionths of a meter) are categorized as germicidal – meaning they are capable of inactivating microorganisms, such as bacteria, viruses and protozoa. This capability has allowed the widespread adoption of UV disinfection as an environmentally friendly, chemical-free, and highly effective way to disinfect and safeguard water against harmful microorganisms.

The following article will highlight some basic UV disinfection concepts along with discussions of some considerations taken when comparing UV and other alternatives for wastewater disinfection.

Figure 1: The world’s largest UV disinfection facility is currently under construction for New York City. It will consist of 56 UV reactors capable of treating 2,200 MGD.
Unlike chemical approaches to water disinfection, UV light provides rapid, effective inactivation of microorganisms through a physical process. The retention time required to achieve disinfection ranges from fractions of a second to a few seconds. This eliminates the need for a chlorine contact chamber, thereby reducing the required footprint and cost of installation.

When designing and sizing a UV system for an application, several water quality parameters must be considered such as peak flow, average flow, UV transmittance (UVT), and total suspended solids (for wastewater). UVT is the amount of UV light that is able to penetrate the water. The upstream treatment processes play a major role in determining the UVT value. Primary wastewater plants would have higher TSS and lower UVT value. Plants with lower UVT are still able to use UV, but typically require more equipment or more powerful lamps.

UV in Challenging Applications
UV has been used in some of the world’s most challenging wastewater effluents. It has been used for the disinfection of large flow applications (Figure 2), combined sewer overflows, primary effluents (Figure 3), and water destined for reuse. Advancements in UV technology, such as high-output lamps and automatic chemical/mechanical sleeve cleaning systems, have made it possible and cost-effective to disinfect challenging effluents without the risks associated with chemical disinfection.

Figure 2: This large wastewater plant in Alabama, USA installed a UV system capable of treating 600 MGD. The required footprint of the disinfection system measures 80 feet by 120 feet – a fraction of the space needed for chlorine disinfection.

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Less Maintenance Through Innovation
UV disinfection technology has evolved immensely from earlier generations of systems. Today’s UV systems require approximately one-third the number of lamps.

Figure 3: This UV system in Hawaii, USA is capable of treating 120 MGD of primary effluent. UV was selected because the disinfection performance was shown to be more predictable than chlorination and no disinfection by-products are formed.

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that were required 15 years ago. Operation and main-
tenance requirements have also been significantly reduced. 
Advancements such as increased lamp output, extended
lamp life, automatic chemical/mechanical sleeve cleaning
systems, automated dose/flow pacing and SCADA integra-
tion make today’s UV systems easy to operate and main-
tain. Table 1 summarizes an example of an actual waste-
water treatment plant that installed a large UV system in

Lower Life-Cycle Cost

The cost of retrofitting an existing chlorination system to
UV is a common evaluation. The capital cost of a UV sys-
tem is higher than a typical sodium hypochlorite system.
Fortunately, the operating cost of a typical UV system is
significantly lower than a hypochlorite system due to the
increasing cost of chemicals.

The retrofit of an existing hypochlorite system to UV has
a high initial capital cost, but over a span of a few years,
the cost of the UV system would provide a return on
investment. This payback is illustrated in Figure 4 (next
page) since the cost of electricity and replacement lamps
are lower than the cost of purchasing hypochlorite. Table
2 (next page) summarizes the items that were taken
into account for the operating cost of the wastewater

treatment plant illustrated in Figure 4. Plants can
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Table 1: This is a comparison of a 20 MGD UV system that
was installed in 1989 and upgraded in 2007. UV technology
has improved significantly over the years with more powerful
lamps and features that greatly reduce maintenance
requirements.
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also benefit from the non-monetary benefits of a UV system such as increased operator safety and the use of UV as a public relations tool to emphasize the plant’s use of “green” technology.

An Inherently Green Technology
The term “carbon footprint” is now a common term in today’s vocabulary. Carbon footprint refers to the amount of carbon dioxide released into the environment by a given process or technology. An evaluation of chlorination and UV disinfection processes in a Life Cycle Assessment (LCA) can be performed to determine the environmental impact of each technology.

In a LCA, various environmental impacts are taken into account such as ozone depletion, global warming potential (carbon footprint), acidification, eutrophication, ecotoxicity, human health effects, resource depletion and land use. When the data is normalized based on the population of a given city, the results can be compared between various disinfection processes. UV has the least environmental impact since the biggest contributor to environmental impact is the transportation of chemicals due to the burning of fossil fuels.

A Bright Future
The advancements in the UV industry have benefited
municipalities through the application of UV in challenging effluents, reduction in maintenance requirements, and implementation of a cost-effective disinfection solution.

The installation of UV in communities has allowed operators to leverage UV as an effective public relations tool to educate the public on how their water is treated in an environmentally-friendly way.

As a result, the number of new and retrofitted wastewater treatment plants that have adopted UV disinfection technology continues to grow each year – enabling operators to continue protecting their communities’ water resources with greater confidence.

All images and photos courtesy of Trojan Technologies (www.trojanuv.com).

More information about UV disinfection is available on the Trojan Technologies website: www.trojanuv.com

Figure 5: Based on a city of 50,000 residents in Washington, USA, the environmental impact of installing UV is significantly less than chlorination. Over time, as the energy source becomes renewable, the environmental impact of UV will be further reduced.

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