Compilation of Abstracts

2014 Operator's Seminar, Banff, Alberta

Online UV-Transmittance Measurement: The Key to Cost Savings

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Problem:

Insufficient or inaccurate historical UV transmittance (UVT) data can lead to the inaccurate design and sizing of a UV disinfection system. In addition to how the UVT parameter is used in the planning stages of a UV project, the inability to detect immediate changes in UVT as part of a facility's continuous water quality monitoring can lead to unnecessary energy consumption (over dosing) or compromised water quality (under dosing). When a UV disinfection facility is in operation, the water conditions often change on a daily basis and the actual UVT could be significantly better than what the historical data has shown for the same time period. This results in over dosing and therefore unnecessary energy consumption because the UV system is running at a higher power than what would actually be required to achieve disinfection. In the same manner, at any given time the actual water quality could also be worse than what historical information on UVT has shown. If this decrease in UVT goes undetected, the UV system will not be able to deliver the required dose and is therefore under dosing, resulting in compromised water quality. This presents a major issue for UV facilities that have not made UVT monitoring a continuous and automated part of their water quality testing.

Objective:

Demonstrate the importance of UVT monitoring in the planning and operation of a UV disinfection system and quantify the results in terms of the potential operational cost savings. This will be looked at in two different areas of UVT data:

1) Collection of UVT data in the planning and design phase of a UV disinfection project can prove to have a significant impact on the future operational costs of a UV system once it has been brought online. The UVT trends help consulting engineers and UV manufacturers to understand the requirements of each new facility based on historical changes in water quality. The result will be a properly sized UV disinfection facility.

2) Monitoring UVT continuously after a UV disinfection system has been brought online is as equally important as collecting historical UVT data in the design and planning stage. Monitoring UVT online can improve UV system performance by eliminating over or under dosing which can represent long term quantifiable energy cost savings. The UVT parameter can also be used to signal issues in a variety of treatment processes upstream from the UV disinfection system that

are designed to remove suspended solids and natural organic matter, which also translates into improved overall treatment results.

Discussion & Solutions:

UVT values should be collected over a period of time prior to a UV system installation and commissioning in order to assist with the design and sizing of the system. Without accurate historical UVT values, UV systems can often be over designed to provide the required dose during the worst case scenario water conditions (lowest UVT) when in fact the UVT is often much higher on a daily basis.

The overall efficiency of a UV disinfection system relies on a few key factors. Lamp output (in terms of power and wavelength) is one of those factors, along with the overall design of the UV reactor and how the water passes through it and past the lamps. One factor that is often overlooked is how all of these variables function together to create an efficient treatment process. UVT is a parameter that significantly contributes to this overall efficiency. UVT information can be used in combination with the intensity of the UV lamps and the flow rate of the water to achieve the dose required to achieve disinfection. The more accurate and more current the UVT information is, the more efficient the overall disinfection process will be. While all three of these parameters (UVT, lamp intensity and flow rate) are important and should all be monitored closely, UVT is the only parameter of the three that can be affected by variables beyond the control of the UV system operator however it is often the first parameter that is overlooked in terms of importance. A high degree of importance should be placed on UVT monitoring in order to accurately detect changes in water quality. This can include changes in water quality due to weather events, seasonal water quality changes or even compromises in water treatment processes upstream from the UV reactor. When changes in water quality are detected, the appropriate action can be taken immediately. This can include adjust flow rate, lamp intensity or both, depending on the desired outcome and to prevent further under or over dosing.

While the UVT parameter is traditionally used as a variable to assist with the operations of a UV disinfection process, there are other known applications for UVT monitoring outside of the UV disinfection process. This includes monitoring before or after a variety of treatment processes designed to remove suspended solids, natural organic matter or both. The UVT parameter is very different from turbidity (NTU) measurements because it can also be affected by changes in dissolved organic matter which would not affect NTU in the same way. This is because UVT is measured at the 254nm wavelength which is absorbed by natural occurring aromatic organic matter in the water whereas turbidity is derived from the amount of scattered visible light measured at 90 degrees to the sample. Many treatment facilities are familiar with turbidity as a general indication of water quality without being aware that UVT can provide a more accurate picture of water quality changes in addition to fluctuations in NTU. Due to the nature of UVT and the bias towards detecting changes in organic matter, the UVT parameter can be used to signal a change in performance of many TOC removal processes such as Ion Exchange, Coagulation, GAC filtration or UF/NF membranes. While UVT is not linearly proportionate to the change in concentration of organic matter in the water, it is a practical alternative to signal an overall change or compromise in the treated water from one of the above processes upstream from a UV disinfection system. This makes it a viable and practical and affordable alternative to other organics monitoring techniques such as TOC.

Limiting the Lagoon

Due to increased concern across North America regarding the health of lakes and rivers downstream of municipal and industrial wastewater treatment plants (WWTP), improving water quality from existing WWTP (as well as new processes) has become a high priority.

Historically, most lagoon systems were designed to remove BOD and TSS from the wastewater stream. Increased focus on the effect of effluent toxicity in the receiving stream, along with possible eutrophication of lakes and rivers, has resulted in new requirements for nitrification of ammonia, and removal of both phosphorus and nitrogen.

The presentation will focus on nitrification fundamentals and give operators the knowledge of the effects that ammonia concentrations, pH and temperatures have on lagoon effluent toxicity, operators can determine if they are releasing effluent that would fail a toxicity test, and determine what upgrades, if any, are required to produce non-toxic effluent.

The presentation will also include the following lagoon upgrade case studies: Mentone, IN, a facultative lagoon followed by a SAGR which achieves effluent ammonia of 0.25 mg/l; Glencoe ON, an aerated lagoon followed by SAGR which achieves effluent ammonia of 0.11 mg/l; and Blumenort, MB, an aerated lagoon followed by a SAGR and ANSAGR which achieves a Total Inorganic Nitrogen (TIN) of <2 mg/l.

The upgraded lagoon systems meet increasingly stringent effluent limits, while maintaining the desirable properties of low overall maintenance, simplicity of operation, and long term reliability that originally made lagoon systems popular.

Speaker Biography

Martin Hildebrand, P.ENG

Martin Hildebrand graduated from the University of Manitoba with a degree in Civil Engineering in 1994. He is currently President and Head of Research and Development for Nelson Environmental. His experience includes research and wastewater technology development as well as process design and optimization of over 200 projects across North America and the Middle East. Primary focus over the past 19 years has been on project and technology development for cold climate municipal and industrial lagoon based wastewater treatment systems.

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Tablet (puck) De-chlorination using a Truck Mounted Diffuser during routine Uni-directional Flushing; the Operators experience at Strathcona County.

Abstract

The Uni-directional Flushing program at Strathcona County has been in operation for a number of years. Methods of de-chlorinating water released into the environment from various utility operations have always been evolving to reduce any known or unknown impact of the effects of chlorine on the environment and to meet or exceed compliance requirements. The distribution operator not only works to protect the water system to provide clean safe drinking water but also must work to protect the water source.

Various types of releases require various methods to de-chlorinate. The purpose of this report is to present the experiences that the Uni-directional flushing crews were challenged with to de-chlorinate flushed water during the routine Uni-directional flushing program. Using a truck mounted diffuser for standard hydrant flushing; a hopper/feeder device for sodium sulphite tablets was built on to it. This enabled the diffuser to de-chlorinate the flushed water before it was released to the environment and entering the soil, storm and/or sewer drains. Commercial variations of the diffusers and feeder systems are readily available but the challenge was to try and build one to better understand the process and results. The data collected in the field measurements was to summarize are we doing it correctly (simplicity of operation and safety to operators), is it actually working (de-chlorination efficiency & over/under application of sodium sulphite), what are the costs (materials, time & labour) and can the operator use the equipment or what was learned and apply it to other applications.

The scope of this report was developed from the Water & Wastewater Operators experiences in the field operating, designing, adapting, and testing the equipment and procedures during Uni-directional Flushing. It is limited in that it is not a measured comparison with other commercial diffusers, chemicals, utility operations, methods, equipment or procedures although there is some discussion.

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Automated Reporting for Water Treatment & Distribution Systems

Presenter: Zane Spencer, C.E.T.

Zane is a Controls Technologist with MPE Engineering Ltd in Lethbridge Alberta. A graduate of the Industrial Instrumentation Technology program at SAIT, Zane has ten years of experience in designing, installing and commissioning process control systems. Aside from his busy professional life, Zane is kept busy at home with his wife and three children. In his spare time, Zane volunteers as a youth soccer coach and on his local volunteer fire department.

Abstract:

Information collected from instrumentation throughout water treatment and distribution systems is often stored on process control system computers. This stored information can be leveraged to meet reporting requirements of Alberta Environment & Sustainable Resource Development (AESRD) as well as other unique reporting requirements for water infrastructure.
The presentation will discuss:

- AESRD's typical reporting requirements
- Additional reporting requirements for water treatment systems
- Additional reporting requirements for water distribution & regional distribution systems
- Data collection and formatting guidelines for report implementation

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How will the federal *Wastewater Systems Effluent Regulations* (WSER) and Alberta's Wastewater Regime work together?

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The federal *Wastewater Systems Effluent Regulations* (WSER) were published in the *Canada Gazette*, Part II on July 18, 2012. Environment Canada (EC) and Alberta Environment and Sustainable Resource Development (AESRD) will each offer presentations concerning the WSER and the provincial regulation of wastewater in Alberta, to clarify how the WSER and Alberta's regulatory regime fit with each other, as well as efforts related to implementation of the WSER in Alberta.

Environment Canada will present a summary overview of the WSER, outlining the main regulatory requirements, and highlighting key compliance points and timelines. Regulatory requirements for the WSER began in January 2013, with initial due dates for reporting requirements in May 2013. This overview will be followed by a brief discussion and update of measures underway regarding implementation, including an update on efforts to develop an equivalency agreement with the province of Alberta, as well as cooperation between Alberta and Canada on interim implementation arrangements for the WSER.

Since the early 1970's, AESRD has issued approvals for the construction and operation of municipal wastewater systems in accordance with Alberta's Environmental Protection and Enhancement Act (EPEA), and related regulations and instruments. AESRD will provide a brief overview of its regulatory system, and outline proposed modifications to monitoring provisions that will enhance its regulatory requirements and maintain its role as a leader in water and wastewater management in Canada. These proposed provisions will also serve to facilitate the development of an equivalency agreement for the management of municipal wastewater in the province. In addition, AESRD will also present its perspective on the development of an equivalency agreement and interim arrangements for implementation of the WSER.

OPERATIONS: CCTV collection

Digital versus Analog Side Scanning versus Conventional

Your home cable, satellite providers are changing all your entertainment equipment to digital. What does this mean in the underground CCTV industry? It means we must change with the times also.

The major players in the market are at a impasse with technology at this time. The module manufacturers of recent years are changing all of their systems to digital and therefore the underground industry must change too.

Not only is the industry changing to digital with higher resolution better imagery, the industry is also has embodied a paradigm shift in how we inspect sewers. Our eyes typically look forward with a peripheral view of approximately 120deg. Camera manufacturers have embodied how the human eye looks, taken that and then completed computer manipulation on the results.

The result of this change is that instead of having to watch miles of perfectly good pipe with the naked eye, the software provided by manufacturers offers the ability to review pipe results very quickly.

This shift in operation allows the operator to run at 4-5x previous speed in the pipe. This shift in operation will allow a new generation of pipe inspectors to inspect and evaluate the pipe at a speed which has not been surpassed in the industry. The speed and quality of these reporting methods allows us to find where we are at with our infrastructure management techniques and continue to the more important more imminent issues faster than ever before. This interpretation may be displayed visually on a interactive map which allows city councils, engineers and other decision makers spend their budget wisely on the most important issues first. No longer are the days when we allocate our budget money to just what has been discovered. First we discover all of our issues and then make better decisions on the all of the information at hand.

Our presentation would be to show how to interpret the results of a side scanning programme and utilizing this technology to further your in house results.

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Development of State-of-the-Art Water Treatment Services throughout the MD of Greenview

The Municipal District of Greenview has a population of approximately 5,000 people spread across an area in Northwest Alberta that is greater than the size of Holland. While two hamlets in the MD have chlorinated well water distribution systems, most residents of Greenview obtain their water through private wells or through one of the MD's ten raw water fill points. The MD's infrastructure is operated and maintained by an operational staff of two.

As part of an aggressive program to maintain the sustainability of its communities, the MD has embarked on a multi-year capital improvement program to provide all its residents with access to high quality potable water through:

- the development of improved treatment and distribution systems in urban areas;
- the addition of new reverse osmosis water fill points where residential, agricultural, industrial and/or commercial demand warrants;
- the replacement of the existing non-potable water fill points with reverse osmosis treatment plants; and
- the expansion of existing rural water distribution systems where practical.

Given the immense size of the MD and its sparse population, the program faces many challenges related to the design and construction of the new treatment and distribution facilities, their operational requirements and the logistics of ensuring staffing needs can be met at each site.

This paper discusses the impetus for developing this major water infrastructure program, how traditional project delivery processes were modified to deal with labor and contractor shortages in the region and how the various project stakeholders, including operations, administration, Council, the consultants, contractors and regulators all worked collaboratively to fulfill a commitment to deliver the state-of-the-art water services to the public.

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An Operator's Guide to WET (Whole Effluent Toxicity) Testing

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Wastewater facilities will soon be required to monitor their effluents by performing whole effluent toxicity (WET) testing as part of the "Wastewater System Effluent Regulations" (Canada Gazette Part II, Vol. 146, 2012). Facilities will be required to conduct WET testing at defined intervals, depending on their size and flow rates per day.

WET tests are effects-based bioassays that use water-borne organisms to determine if an effluent will negatively impact the receiving environment (i.e., show toxic effects). A number of species representative of the different trophic levels present in aquatic systems are used, including plants, invertebrates, and fish. The test battery includes bioassays that measure acute (i.e., short-term) effects, such as survival, as well as those that measure chronic (i.e., long-term) effects, such as reproduction or growth.

Although the initial phase of this program will involve monitoring only, it is likely that some follow-up will be required should "toxic" effects be found within the effluent provided. If this were to occur, a pH stabilized trout test can be performed to eliminate ammonia as a potential toxicant. If toxicity is still present, a forensic investigation known as a "toxicity identification evaluation" (TIE) could then be conducted in order to isolate and identify the sample component(s) causing the observed toxicity. Once the primary toxicant has been identified, an effluent treatment plan can be designed to remove or reduce this toxicant.

A general overview of the WET testing that will be required under the Wastewater System Effluent Regulations will be provided. This overview will include details on trout toxicity testing and testing options in the event of a toxic result.

Centrifugal Pump Innovations

This seminar is geared towards challenges experienced in the wastewater industry around maintaining prime in centrifugal pumps. It begins with a review of the basics of priming centrifugal pumps. Market standards and innovations around this technology will be introduced.

A video of a 30” by 30” pump capable of moving such great amounts of water in a short time will be shown. The pump can empty a swimming pool in less than a minute. A review of this pump will be provided.

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Flood of 2013 – Maintaining Operation of a Raw Water Intake and Pump Station

Submitted with Stantec: Stephan Weninger

The Town of Redcliff operates a raw water intake and pumping station on the banks of the South Saskatchewan River. In the Fall of 2011, MPE Engineering Ltd. was commissioned to complete the design and construction management of a major water treatment and related infrastructure upgrade project.

This project included the upgrade and redesign of the raw water pumping station. Historically the facility had been prone to damage and significant operational concerns related to high river events. As a result, MPE completed the design of significant modifications to the existing pump station to ensure operation could be maintained during a 1:100 year flood event. Detailed design and tendering of the project was completed in 2012 and construction began in early 2013.

The major flood event that hit southern Alberta in June of 2013 saw the South Saskatchewan River level peak at the 1:100 year flood elevation during the latter stages of construction of the new facility. The flood event provided a unique opportunity to test the design of MPE under real world conditions, to test how the new facility would operate under a true 1:100 year flood event. Throughout the event, and with the hard work of the operators and the contractor, the supply of raw water to the water treatment plant was maintained. Upon review after the water levels receded, it was determined that no additional modifications to the design would be required and construction could continue. This paper will provide a description of the design, a discussion of the construction phase, and a detailed account of how operation of the facility was maintained during the flood event.

The pumping station was put online in September of 2013 and the project was completed in December. The new facility will work to supply water directly to the new water treatment plant to be completed in the summer of 2015.

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LLOYDMINSTER'S INNOVATIVE NEW TURBO BLOWER AERATION SYSTEM

Abstract – Submitted with Stantec (Stephan Weninger)

In 2012, the City of Lloydminster became the first wastewater treatment plant in Canada to use ABS turbo-blowers for an aeration of a lagoon system, and just the second overall installation in a Canadian WWTP. At that time, the plant experienced an immediate reduction in power consumption and improvement in its treatment process. The new blower system improved operability by providing the ability to adjust total airflow and airflow between aeration cells, the elimination of the need for hearing protection in the blower room, and a virtual elimination of vibration of the blowers under operation. Over the past year, plant operators have had an opportunity to test the new blowers under a wide variety of operating conditions and have been extremely pleased with the results.

The paper will review the impacts of the new blowers on plant power consumption and treatment performance, and provide commentary on how the anticipated long term benefits of the new system compare to the Plant's long term operational cost projections and proposed process upgrades. The benefits of the new technology will also be reviewed as they relate to the improved workplace health and safety conditions at the WWTP site.

The paper will also discuss the selection of the blower technology and the design of the blower room and yard piping retrofits to provide enhanced air flow delivery and operational flexibility throughout the treatment process. The blower procurement, delivery and installation will be reviewed as will the development of construction staging.

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Save Your Municipal Infrastructure Through Packaged WWT/DAF (Diffused Air Flotation) Technology

Do you have clients within your municipality that are discharging high strength sewage into your collection system, i.e. Beverage producers, Meat packing plants, Food manufacturers and Commercial launderers. Packaged WWT/DAF technology is cutting edge on the removal of TSS, BOD, CBOD, FOG, TKN and TP. This technology provides a relatively small foot-print and can be retro fitted to any existing discharge system, requires a minimal amount of chemicals, is expandable and requires no media change for the life of the system. This technology will exceed all environmental and municipal discharge bylaw regulations and can eliminate any surcharge/over-strength fines you may be encumbering existing clients with.

We would have no problem filling a 45 minute Technical Session with a case study including power point and hand outs.

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Treatment of Groundwater Containing Naturally Occurring Ammonia and Manganese

Naturally occurring ammonia is common in ground water of Southern Alberta; often it is accompanied by Manganese.

- The Code of Practice (COP) For Waterworks Systems Using High Quality Groundwater, dated June 1, 2012 has a requirement of 4 log reduction of Viruses;
- The 4 Log reduction is meant to be achieved by maintaining a free chlorine residual;
- Because of naturally occurring ammonia in raw water, break point chlorination is required before a free chlorine residual can be maintained;
- Increasing the chlorine dosage in order to maintain a free chlorine residual triggers an increase in the amount and speed of manganese precipitation.

The presence of ammonia contributes to chloramines formation when chlorine disinfection is conducted. This presents a challenge to a disinfection process. This significantly increases disinfection contact time and would require excessive contact reservoir volume. Alternatively water with higher ammonia would require injection of a chlorine dose exceeding Break Point. However, excessive chlorination may contribute to disinfection byproducts formation.

MPE and Procesco designed and commissioned two water treatment plants in Alberta (Cremona and Empress) using biological removal of ammonia and subsequent manganese removal by manganese dioxide media filters. Biological treatment is based on naturally occurring nitrifying bacteria growing on Granular Activated Carbon (GAC) media. Ammonia removal is achieved in the presence of a sufficient amount of oxygen. Chlorine is then added to the water with reduced ammonia for manganese precipitation and continuing regeneration and free chlorine residual. Chlorinated water passes through manganese dioxide filters which retain manganese and then is diverted to storage.

Biologically treated water allows achieving free chlorine residual and subsequent manganese removal.

An applied treatment scheme reduces manganese concentration below the aesthetic objective and provides free chlorine residual with reduced chlorine consumption.

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Experiences and Leanings from DAF Optimization

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Introduction

Dissolved air flotation (DAF) process is commonly used to thicken waste activated sludge (WAS) generated from the biological nutrient removal (BNR) process to prevent phosphorus release from WAS. Poor DAF performance resulted in thickened waste activated sludge (TWAS) concentrations of 3 % which was lower than design criteria of 4.0 % TS. Sludge was carried over with subnatant, and only 70 to 75% of WAS could be treated by DAF during normal operation, the remaining WAS had to be returned to the headworks and went through primary clarification and the BNR process. The consequences of this practice caused phosphorus to release from WERE in the primaries, reduced primary efficiency, and increased overall loading to the downstream BNR process. Also, low TWAS concentration resulted in greater volumes of sludge requiring processing in the digesters, reducing overall digester capacity.

Objectives of DAF Optimization

The objectives of DAF optimization were to increase TWAS concentration to meet design criteria of 4.0%TS, increase the percentage of WAS treated by DAF and improve overall process safety, and regain digester capacity as well.

Approaches/Methodology

Historical DAF operating parameters were evaluated against design criteria and challenge tests were conducted to verify DAF hydraulic and treatment capacities. Based on evaluation and test results, the following actions were taken to improve DAF performance:

- Provided sufficient polymer dosage and air/solid ratio.
- Replaced manual sludge skimmer control with automatic control, installed online subnatant quality monitoring device, optimized control strategy to achieve proper TWAS inventory in DAF tank, and eliminated sludge carried over with subnatant.
- Developed comprehensive operating procedures and training course to enhance operator's knowledge and skills.
- Improved reliability of the polymer system and skimmers, significantly reducing equipment downtime.
- Created process monitoring tool and process control model for operating parameter adjustment when process conditions change.

Results/Conclusion

After the DAF operation was optimized, TWAS concentration has exceeded design criteria of 4.0% TS (averaging 5% to a peak of 6%) and TWAS volume has been reduced by half. All (100%) of WAS is now treated by DAF, eliminating the need to send WAS to the headworks, which significantly improves process safety. Meanwhile, the digester feed %TS has been increased and digester capacity has been recovered.

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Abstract

A wastewater collection system moves the sewage from point A to point B, period. We would all agree this is the single most important parameter when looking at wastewater collection. What is the second most important point in sewage collection? Is it how far you have to transfer the sewage, how quickly it's transferred or how much maintenance is required? Could the second most important point be whether you can transfer the sewage before it starts to stink!? With any topic or process there are a few vantage points and the one that is explored in the following operations forum deals with the smell of the system rather then the sight of it.

Odour generation, sewer gas, sewer burps, sewage stink or what ever you refer to it as, is a small part of wastewater collection that is a by product of moving sewage from point A to point B. This small by product has very little impact on final treatment but has a lot to do with how the public perceives successful transmission of sewage. If a manhole is releasing odours the public will undoubtedly think that you in operations are not doing your job correctly. You can explain until you are blue in the face that the sewer is brand new, the VFD pumps work great, or that the final effluent of the WWTP is the best in the province, but it is all for not if the collection system stinks!

Sometimes it smells and other times it doesn't you may say. No matter what you have been told sporadic odours are almost impossible to completely treat and are usually from an isolated event. The next questions you should ask is 'Are the odours really sporadic, or can you trend them?' Odour generation is rarely constant in a collection system. If your system has a large residential input a leading factor for odour generation is **Diurnal Flows**. This is basically the trend between collection system flows and human activity.

Odour generation has a lot of contributing factors or building blocks. Having a stable base of organic material and BOD is usually enough to build a large odour issue. Most odour issue's have hydrogen sulphide as the driving factor. It has a pungent rotten egg smell that is noticeable in concentrations as low as 0.1 ppm or 100 ppb! If the building blocks are present in the sewage it is only a matter of time until odour issues arise. The amount of time before odour generation varies depending on the contributing factors.

Adapting your approach or modeling your odour treatment to account for diurnal flow is not as difficult as it may sound. Many of the resources required you may already have or have readily available. This will allow for a greater understanding of the odour issues and how to proceed with your treatment options. Accounting for diurnal flow patterns in your odour treatment will optimize the performance and may even save money.

Upon further investigation the real question will not be whether you have a diurnal influence on your collection system but rather, considering mounting odour complaints and odour treatment cost, can you afford not to acknowledge it moving forward!

AWWOA Annual Operator Seminar 2014 – Technical Session Proposal

DRAFT – DECEMBER 13/13 (based on information from Winslow Davis)

Development and early implementation of an Alberta region-wide online remote water monitoring system for First Nation Communities

First Nations (AB) Technical Services Advisory Group (TSAG) was formed in 1998 to assist First Nations communities achieve and maintain high standards for community infrastructure, asset management and emergency services, including water and wastewater. Water and wastewater utility operations are supported through a Circuit Rider Training Program (CRTP).

Since March 2012, the First Nations (AB) Technical Services Advisory Group (TSAG) has been deploying an Alberta-region wide online remote monitoring solution for local water treatment plants (WTPs). To-date, 58 of 61 installations are complete, with 48 in current operation. The WTPs send real-time monitoring data via high speed Internet connections to a TSAG Network Operations Centre in Edmonton.

Several aspects of this technical solution cost-effectively improve drinking water quality assurance. A project of this magnitude using this particular technology had not been done anywhere else in the world prior to the TSAG installation. The lessons we've learned are transferable to other geographically-disbursed water treatment operations, including several of Alberta's more expansive and remote municipal districts and counties.

The technical solution uses vendor-supplied spectrometer probes that are installed in the water treatment plant process piping as potable water enters a community's local distribution system. The monitoring process utilizes measurement via the spectrum of light, which practically speaking means it analyses parameter changes using light. Unlike traditional monitoring processes, it does not rely on the use of reagents, making it cost-effective and low-maintenance.

In early implementation we have been monitoring four parameters including Total Chlorine, Free Chlorine, pH, and Turbidity. Temperature and NO_3 are also monitored. Samples are taken every five minutes and timing can be adjusted remotely. Alarms are presently sent out by SMS text messages and by email when a parameter is found outside the operator specified min/max range. The reporting module enables daily, weekly, monthly, semi-annual and annual reporting. The process has trend analysis capability relying on specific 'finger prints', so the longer it is in use, the better it works. This process could also be used for raw water monitoring and wastewater monitoring. Pilots are being considered.

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LET'S TALK ABOUT WIPES

A few toilet paper manufacturers have been doing a major advertising push for the use of their personal pre-moistened "Flushable" wipes. One advertising campaign even has a Facebook page where the topic is "Let's talk about your bum."

Unfortunately the results of the success of this advertising campaign focused on society's obsession with personal cleanliness can be seen directly downstream.

Talking to operators, these 'flushable' items are clogging up sewer lines, plugging up pumps, and causing higher solids loading issues at wastewater treatment facilities.

We need to distinguish between 'what is flushable' and 'what should actually go down the toilet'.

According to many consumers hooked up to municipal waste systems, 'flushable' is whatever can make it down the toilet without plugging up the toilet, the pipes in the house or the line out to the street. From there it is just magically 'flushed away' and is no longer their concern.

But we all know there is no magic 'away'. Someone has to deal with it.

This presentation will discuss:

-Educating the public: what should or shouldn't go down the toilet; where it ultimately ends up; how the treatment process works; and the costs to them as taxpayers in operator time, equipment maintenance & loss of operational efficiencies.

-The difference between 'flushable' and 'dispersible': working with both the public and manufacturers of these products to reduce the impact on treatment processes of these 'flushable' items.

-Mitigation options including: prevention, reduction and removal. The best option is prevention, but once the objects are in the process stream there are steps that can be taken to reduce the impact on pumping stations and the wastewater treatment process. Some of these options will be discussed in general terms, including 'separation' options to send these items to landfill, where they should have gone in the first place.

Presented by:
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Development of new solutions for the biological treatment of wastewater.

In today's world of wastewater treatment there are many complex systems and with the increasing demands from government regulations create a variety of issues. This paper and presentation will be looking into the areas of chemical and civil engineering, with the application of biotechnology in the field of biological sciences. One of the biggest concerns for treatment plants and lagoons operators is the capacity that the system can hold. Many of these facilities are facing costly solutions to resolve a sludge build up which is making it increasingly difficult to maintain the desired capacity, meet more stringent government enforced effluent standards, and keep up to increased volumes through their systems. There are few solutions in dealing with sludge build up, most are costly or not effective. These issues are not improving and are felt across the board from lagoons, to treatment plants from the developed countries of North America and Europe to third world countries in Africa and South America. There is a great need to find alternative solutions to manage sludge build up in an affordable, clean, and environmentally safe manner without major capital expenditures of infrastructure. We will be discussing the current available alternatives and practical treatment outlining the associated costs both financial and environmental as well as any challenges facing the treatment of sludge build up and removal. It is proposed that the world and industry is in need of a biologically engineered product to enhance the anaerobic and aerobic breakdown of the sludge into a liquid state while removing harmful substances that lead to cholera and typhoid is ideal. Bio-technology can provided the ideal solution. This solution would require less energy-intensive water treatment by exploiting microorganisms for wastewater treatment. By gaining a better understanding of microbes and their capability of degrading various materials so as to harness them for wastewater and waste treatment. This type of treatment can increase the rate of decomposition through bio-augmentation and assist in the increase the rate of CH_4 gas being released.

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Small (Micro) Water Systems: Operation with Volunteer Stakeholders.

The high cost of operating small water systems has been discussed in previous seminars. The experience of Ranchers Hill Water Co-op, a small system serving eleven homes in a country residential development, will be reviewed. The cost savings and unexpected benefits of volunteer residents taking over the routine operation will be presented.

The system consists of two high quality groundwater wells, ozonation, chlorination, treated water storage and distribution. The relatively low time requirement for performing the daily routine and the need for 24/7 availability to respond in case of emergency made it extremely difficult to find a contractor at a cost the stakeholders would accept.

The presentation will show how easy access to the on line course and certification of a resident operator helped. The financial management, operation, some maintenance and auditing were all successfully executed on a volunteer basis. Unexpected benefits included: using expertise of retired Co-op members, increased awareness and interest from water users, sampling in individual homes, residents offering to do ground maintenance around the pump house, 24/7 security and creating a social environment with potlucks and BBQ get togethers.

Special problems of operating a micro water system with a low water usage will also be reviewed.

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2014 AWWOA Operators Seminar – Banff AB

Abstract Submission

Title: Chemical Feed Systems - Design, Installation, Operations and Maintenance

Presenters: Max Wong, M.A.Sc., P.Eng. **AND** Harry Chan, B.Math.

Technical Sales

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Abstract:

Accurate metering of a variety of chemicals is essential for the performance of water and wastewater treatment plants. Every WTP and WWTP has multiple chemical feed systems, including but not limited to systems serving: coagulation, flocculation, chlorination, fluoridation, membrane cleaning, pH adjustment, phosphorus removal, odour control, and solids dewatering. Plant staff regularly work with and maintain chemical feed equipment.

This presentation will cover the following topics:

- Applications for chemical in water and wastewater treatment
- Types of chemical feed pumps on the market today – selecting the right type for your specific application
- Design considerations for chemical feed systems
- Installation considerations
- Operations and maintenance overview

2014 AWWOA Annual Operator Seminar

RESPONSE TO CALL FOR PAPERS

SUGGESTED TITLE: Operator to Operator Coaching – the Northern Alberta Experience

PROPOSED TOPIC AND RELEVANCE FOR ALBERTA OPERATORS:

Many smaller municipalities have few resources and experience challenges when operating, maintaining and managing their water systems. This paper will outline common challenges, lessons learned, and stories of early successes associated with the delivery of Operator to Operator Coaching in two Northern Alberta Communities.

Aquatera has been working with the Closer to Home Initiative (C2H) since August of 2012 as a resource for smaller northern communities experiencing challenges with their water and wastewater operations. Geographically surrounded by small northern communities, Aquatera has had opportunities over the years to lend a hand to our neighbours with their water and wastewater systems. During that time, we have experienced many of the same challenges time and again.

This presentation will outline some common challenges we have experienced, some lessons we have learned and some early results from the coaching work we have done in partnership with C2H.

Operator to Operator coaching occurs every day in Alberta. Whether it is on an informal basis by telephone, by more formal arrangement between communities, or by specific coaching engagements.

C2H engaged trainers from the Edmonton Waste Management Centre for Excellence (EWMCE) in the development of a Coaching for Operators Guide and Course. This course was delivered in Red Deer and Edmonton in early June as well as in October.

This presentation will:

- Introduce the Coaching for Operators Guide and Course
- Provide overview of Aquatera's experience with smaller northern communities including common challenges and early learnings from the perspective of working with CAO's, managers and operator coaches
- Share a unique perspective from an Operator Coach engaged by the C2H initiative in two Northern communities. This will include discussion of unique challenges associated with being an Operator Coach and clarification of what coaching "is" and "is not".
- Share some of actual experiences and use real life examples to illustrate challenges, opportunities and benefits of the coaching model.

Provide a call to action for Operators – to get to know their neighbours and to reach out as a resource as Operators are most uniquely equipped to assist other Operators.

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Government of Alberta

Environment & Sustainable Resource Development (ESRD)

Monitoring Requirements, Sampling and Electronic Reporting

Within all authorizations (approvals and codes of practice), monitoring requirements are legal requirements to monitor and/or sample. These can be for a variety of parameters at different locations within an operational system. Sampling and accurate sample identification is key to tracking compliance. The acceptable mode of the receipt of resultant sample data is electronic reporting, either by web data entry and/or by ESRD specific file format. PDFs and word documents are digitized paper, not electronic data.

This talk will give an overview of current electronic reporting of drinking water, sample identification for contract laboratory analysis, and **changes to the Provincial Laboratories policies and forms regarding bacteriological sample analysis processes**. A handout will be available.

The final portion of the talk will deal the proposed electronic reporting of wastewater data to ESRD.

Kathleen Pongar

Regulatory Data Systems
Government of Alberta, Environment & Sustainable Resource Development (ESRD)

Corporate Services, Informatics, Enterprise Data & Information Management (EDIM)

A Tour of the Devon Water and Wastewater Treatment Plants

This presentation will take the form of a tour of the Town of Devon Water and Wastewater Tretment Plants. The water plant is currently a Class III plant with solids contact clarifiers. The dual media rapid sand filters were recently upgraded to member filtration. The Wastewater Plant is a class II plant with primary clarification, 7 rotating biological contactors (RBC's), secondary clarification, followed by chlorination and dechlorination. The plant also has a gravity sludge thickener. I will discuss the history, changes, operational challenges and successes, and the plans for the future of these facilities.

Jim Hepler
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Aquatera's Approach for Establishing New Instream Flow Needs (IFN) Targets that Protect Aquatic Habitat and Meet Long-Term Water Taking Demands

Rick Palmer (Palmer Environmental Consulting Group) and Ashley Parker (Aquatera Utilities Inc.)

Aquatera Utilities Inc. (Aquatera) currently operates under a long-term water diversion licence to provide the City of Grande Prairie and surrounding area with potable water from the Wapiti River. Under the terms of this licence, Environmental Flow recommendations commonly referred to as Instream Flow Needs (IFN), have been established using the Alberta Desktop Method (ADM). The IFN targets established using the ADM are highly conservative and designed to ensure protection of aquatic ecosystems in the absence of further study.

The IFN targets established using the ADM for Aquatera's water abstraction are considered overly conservative and may not meet future water taking demands. To establish new IFN targets specific to Aquatera's water taking and the Wapiti River watershed, Palmer Environmental Consulting Group, in partnership with Normandeau Associates, has designed a precedent-setting Instream Flow Study to scientifically assess the hydraulic impacts to fish habitat from this water taking.

Two different approaches for hydraulic habitat analysis will be utilized: Physical Habitat Simulation Modeling (PHABSIM) and River2D. A technical working group will be established in February 2014, and the study will commence shortly after with under-ice surveys, transect establishment, flow and bathymetry mapping under various river stages for an 85 km reach of the Wapiti River between the Smoky River and the Redwillow River. Hydraulic modeling will be combined with habitat suitability curves to produce an overall habitat model to quantify the relationship between stream flow and fish habitat for the fish species of interest. A quantitative assessment of the potential impacts to fish habitat under different water taking scenarios will be provided, which will allow for the development of new IFN targets to meet Aquatera's water taking needs and protect the aquatic environment within the Wapiti River watershed.

The proposed study has been developed in consultation with Alberta Environment and Sustainable Resource Development, Fisheries and Oceans Canada and the Wapiti River Environmental Sub-Committee, with the goal of developing new methodologies for determining IFN targets for the Wapiti River and integrating the results into a Wapiti River Water Management Plan. If successful, this study could change how long-term water takings are permitted and provide direction for other operators to manage their long-term water use.

Rick Palmer
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Does Your Submarine Have a Screen Door?

Presenter: Henry Flattery
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No restriction on days that the presentation can be made

Session length preference – 45 min

No other equipment needed

Abstract:
Most cities across the country are in a crunch between budget challenges and the costly need for upgrades and repairs to their infrastructure. This is especially true of their sanitary sewer systems, many of which are several decades old and built as a combined sewer overflow system. With the number of residential and industrial connections to sewer systems growing, sanitary sewer flows have increased beyond what they were originally designed to handle.

Add into this equation that inflow and infiltration (I&I), the extraneous water getting into sanitary sewers, and an unprecedented number of large storms that have hit North America the past few years, and you can see why so many municipalities, engineering firms and industry suppliers are working on solutions to I&I. Cities can no longer allow the sanitary sewer overflows to occur on a regular basis for fear of polluting streams, rivers, lakes and groundwater. They also can no longer afford to pay for the conveyance and treatment of the extra water during every occurrence of a major storm. But as improvements and repairs are made, with laterals, pipes and manholes sealed, could everyone be overlooking an important source of I&I, thus leaving a screen door in their submarine?

This presentation will explain not only how inflow and infiltration into sanitary sewers increases processing costs and leads to unwanted sanitary sewer overflows, but also how cities can effectively and efficiently prevent this from occurring in the future. Included with the presentation will be case studies from projects in North Glengarry, ON, Moncton, NB, Mundare, AB and the Washington Suburban Sanitary Commission surrounding Washington, DC.

Learning Objectives – Attendees will be better able to:

1) Understand the implications of inflow into sanitary sewers.
2) Determine the effectiveness of rehabilitation at the top of their manholes.
3) Select the proper solution for preventing inflow into manholes.
4) Realize the financial and environmental benefit of proper rehabilitation.

The Science of Mixing and Improving Water Quality in Water Storage Tanks

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Introduction

Deterioration of water quality in finished water storage tanks and reservoirs is one of the most important issues facing water utilities. The most common problem in reservoirs is the loss of disinfectant residual resulting from hydraulic short-circuiting, poor mixing and circulation, thermal stratification and excessive water age due to low volume turnover. These factors are major contributors to disinfection by-product (DBP) formation and nitrification in chloraminated systems. Many of these water quality problems can be specifically attributed to the location and orientation of the inlet and outlet pipe(s) and the overall operation of the tank. The proper design of the inlet and outlet piping, or mixing system, can eliminate stagnant areas or dead zones achieve complete mixing in the tank, and improve water quality.

This presentation discusses the science of hydraulic short-circuiting and mixing in storage tanks (reservoirs, standpipes and elevated tanks). Computational Fluid Dynamics (CFD) models and 3D Laser-Induced Fluorescence (3DLIF) scale models are used to illustrate mixing and how it is impacted by tank style, inlet and outlet pipe configuration, inlet momentum, and temperature differences between source and tank water. Both passive and active mixing systems are discussed and several case studies are presented that use “before” and “after” sampling data to show improvements in water quality after the installation of a mixing system.

Biologic Dangers Pose New Threat To Sewer Workers' Health

Sanitary sewer workers work in a wet and filthy environment. It's common knowledge that wastewater contains vast amounts of viruses, bacteria and parasites which are known to be harmful to humans and that number continues to grow rapidly. Recent medical reports of sewer worker illnesses are now being linked to prolonged exposure to raw sewage.

In the last several years, medical studies have informed us that harmful bacteria have become much more dangerous and harder to treat than in years past. Bacteria have now acquired the "ability" to resist many of our strongest antibiotics and can quickly share this trait with other bacteria. Recent studies of wastewater systems have shown that one of the most resistant and dangerous bacteria, MRSA, (formerly found only in hospital isolation areas) is now commonly found in sanitary sewer lines and in a number of wastewater treatment plants causing new safety concerns. We have also learned that the pharmaceutical industry has drastically reduced its R&D efforts to develop new antibiotics. In short, infinitely stronger bacteria and a rapidly declining supply of effective treatments.

Viruses are also more dangerous today because they are consistently demonstrating their ability to mutate into something different and possibly, more dangerous.

Observation of work patterns in sewer cleaning operations reveals the primary source for sewer workers contact with wastewater is via the jet hose. As the jet hose is inserted and removed from the sewer line, it is constantly being positioned and repositioned by hand. Bacteria and viruses on the jet hose are transferred to the sewer workers' gloves and clothing. They then find their way onto everything touched (mouth, eyes, cuts, scrapes) including all commons surfaces and control devices on the sewer truck. If the uniforms are taken home for washing, there shared with their family.

How can we reduce the sewer worker's contact with wastewater while still allowing them to handle and manipulate the jet hose as required? By "cleaning" the jet hose before it exits the manhole. A laboratory study has demonstrated a 98% reduction in bacteria and viruses on the jet hose surface as a result of using new safety equipment currently being added to many sewer cleaning trucks. The result: a significant reduction in sewer worker exposure to bacteria and viruses and reduction of cross contamination of raw sewage into the environment.

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Successful Membrane Commissioning – Shaftesbury WTP

This paper describes the commissioning process for a low-pressure membrane system at Peace River and identifies some key items that operators and engineers need to consider for successful commissioning, including:

- Construction and demolition staging
- Temporary piping and pumping strategy
- Co-ordination with commissioning of other plant systems, e.g. chlorination
- Approval amendment

The Town of Peace River recently replaced the granular media filters in its Shaftesbury water treatment plant with a microfiltration membrane system as part of a major upgrade to increase the plant's capacity. The upgrade was completed in two stages, with pre-treatment sedimentation basins commissioned in Phase 1 and the membrane system commissioned in Phase 2.

At Shaftesbury WTP, the granular media filters remained in operation to maintain areliable supply of potable water while the membrane system was tested. This was achieved using a temporary feed line and one of the new re-lift pumps to supply clarified water to the existing sand filters, while the other two re-lift pumps supplied water to the membranes. Filtered water from the membranes was discharged to waste during initial testing.

Speaker:

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Modeling and Optimization of Preventive Maintenance Activities for Wastewater Collection System

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Preventive maintenance (PM) of wastewater collection system is an essential component of urban infrastructure management. It involves several activities such as visual inspection (VI), low pressure flushing (LPF), high pressure flushing (HPF), mainline televising (MTV), hydromechanized cleaning (CHF), which are carried out at pre-scheduled locations across the city on a periodic basis. However, planning and scheduling these activities can be challenging due to the wide variation of actual on-site productivity, which depends on a number of factors such as location, properties of the pipes, frequency of flushing, time of day, season, and so on. The first part of this paper presents a model for estimating the on-site productivity of high pressure flushing (HPF) based on such predictor variables. The model has been developed using historical data from Drainage Operations group at the City of Edmonton, where 5,500 km of network is maintained through over 1400 prescheduled HPF routes. The panel dataset utilized in the study has been obtained by integrating several databases, one of which is the historical data (spanning over 4 years) collected by the GPS device installed in the flushing trucks. The model provides significant insight into the factors affecting PM productivity, and can be effectively used for benchmarking, resource planning, and route scheduling purpose.

The second part of this paper presents an optimization model for PM scheduling, which can be considered a variant of well-known Traveling Salesman Problem (TSP) or Vehicle Routing Problem (VRP). However, preventive maintenance of wastewater collection system possesses a unique characteristic of having short-duration stochastic on-site flushing duration and a specific shift length. Therefore, the presented algorithm aims at maximizing effective cleaning time within the daily work-shift, while minimizing the travel time. The results suggest that the proposed algorithm can reduce the PM vehicles' weekly travel distance by a significant margin. This study also provides useful insight into the effect of site scheduling and work-shift length on maximizing daily effective work time. The outcome of this research can reduce fuel consumption and emissions caused by vehicular travel, and thus supports sustainable practices in infrastructure operation and maintenance.