Special Section: DISINFECTION

PLUS

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In this edition of INFLUENTS, you will be reading about effluent disinfection using traditional, new and emerging technologies. Some of these include chlorination, ultraviolet (UV) irradiation, ozonation, and addition of peracetic acid. Disinfection to remove or inactivate microorganisms is one of the most important steps in wastewater treatment; preventing downstream users from contracting waterborne infectious diseases caused by microbes commonly present in treated effluent. Effluent disinfection also helps prevent the accumulation of harmful microorganisms in fish, shellfish and other aquatic organisms. Disinfection of municipal wastewater is necessary for safe potable water supplies and for healthy waterways.

Chlorination is by far the most common method of effluent disinfection in Ontario and worldwide, and is known to be effective in destroying a variety of pathogenic bacteria, viruses and protozoa. Wastewater chlorination was initially applied in 1910 in Philadelphia, PA, and was soon implemented in many other cities in North America and elsewhere, based on this early success. Ironically, the most significant disadvantage of chlorine disinfection of wastewater is, in fact, its most significant advantage in disinfection of drinking water – a persistent residual. Recent standards that limit chlorine residuals in treated effluent to levels that are non-toxic to aquatic species have brought about the need for chemical dechlorination, which adds to the cost and complexity of chlorination alone.

New technologies such as UV irradiation are becoming widely applied, particularly where non-toxic effluent is required. The first full-scale UV disinfection system was for drinking water in Marseilles, France in 1910. However, because of the competition from the use of lower-cost chlorine for disinfection purposes, UV development lagged behind for several decades. In the 1950s, there was a renewed interest in UV disinfection technology due to advances in UV lamps and electronics, as well as growing taste and odour concerns with chlorination of drinking water. By the early 1990s, there were over 2000 drinking water installations in Europe using UV irradiation. Application of UV disinfection in North America has progressed differently. While not as popular in water treatment, UV disinfection has gained widespread use in wastewater treatment throughout the US and Canada, since it does not involve the transportation, storage and handling of regulated chemicals like chlorine, nor does it leave a residual in the treated effluent.

Ozonation has not received such wide acceptance in wastewater treatment, primarily due to the cost of ozone generation equipment and the special operations and maintenance requirements. However, it is widely used in municipal water treatment. The first full-scale use of ozone as a disinfectant was for drinking water in Nice, France in 1906. Closer to home, and on the wastewater disinfection side, Montreal plans to be the first metropolis in the world to disinfect all of its wastewater using ozonation. Its disinfection project at the Jean-R. Marcotte Wastewater Treatment Plant is scheduled to take place over the next five years. Other cities, such as Indianapolis, IN are using ozonation to disinfect wastewater, but Montreal’s will be the first to disinfect on such a large scale using this method. Montreal’s plant is reported to be the third largest capacity wastewater treatment plant in the world, behind Seoul and Hong Kong.

Emerging technologies for effluent disinfection include the application of peracetic acid (also known as peroxyacetic acid). While new to Ontario, it has been used successfully as a replacement to chlorination and/or a supplement to UV disinfection for over 15 years in Europe.

The emerging debates on disinfection over the next few years will likely be associated with disinfection by-products, effects of disinfection on micro-constituents, seasonal disinfection and the total carbon footprint of disinfection alternatives. Enjoy this edition of INFLUENTS. We look forward to your feedback.

(Sources: American Chemistry Council, International Water Association, USEPA, Degremont, Siemens, Wikipedia)
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It is often difficult to know what to write about in this corner. There is so much activity within the WEAO organization that it is difficult to keep track of it all. In particular, remembering when each activity has taken place. As you understand, some issues and associated activities never go away, so you may hear of them across many INFLUENTS issues. I hope not to repeat myself too many times.

As you know, WEAO has been working on its new five year Strategic Plan. This is a dynamic document laying out the basic principles members have identified as being important for a successful association. Professional staff, the committee chairs, and committee members, have been fine-tuning committee goals and associated activities. Rest assured, the association has been moving ahead on the overall Strategic Plan goals as identified in 2009. As with any dynamic process, there is always a need to review the status of, and/or modify, activities.

“How do we know when we achieve our goals, or need to change direction?” To answer this question, we need to understand that all WEAO members have the opportunity to review the Strategic Plan and specific committee goals at any time. They are posted on the WEAO website (www.weao.org) and are changed as required. Secondly, your Board and committee chairs represent you, as members of WEAO, in the development of the Plan and activities. To ensure the planning and implementation phases are completed, there will be checks and balances in place to monitor and guide committees and their proposed activities in order to achieve the goals of the Strategic Plan.

This will be done through the Committee Chairs Group, the Board, and the annual strategic planning session held each fall. The overall Strategic Plan has listed Program and Operational Goals (2009-2013). The committees, Board, Executive Administrator (EA) and Executive Director (ED) have identified specific activities to achieve these objectives. Both the EA and ED provide the Board with monthly updates of activities. Through review of these updates, the Board can verify that the EA and ED are meeting their proposed objectives. Similarly, the committee chairs meet with the EA and ED quarterly. At this time, each chair provides an overview of their past and proposed activities for the next quarter, identifies any concerns they might have, and identifies any issues that should be brought to the Board. The Board members are invited to these meetings, but also receive the minutes, which allows for a flow of information. The ED reports to the Board on the Committee Chair Group meetings, which provide a second opportunity to share status of activities and address issues that may cause a deviation from planned activities. There is also a Board liaison assigned to each committee, who can report to the Board at any time on committee activities. The ED has an overview of all committees and can verify that implementation of the Strategic Plan components is occurring. Any questions on the process or specific details of the Strategic Plan can be addressed to me at any time (Catherine.Jefferson@weao.org).

One of the major issues we are addressing at this time is the WEAO and CWAA comments made to Environment Canada, on the proposed Federal Regulation under the Fisheries Act for municipal wastewater effluent. CWAA met with Environment Canada and has formed a small group of interested parties from across Canada. Their task is to provide suggestions to the federal government on changes that will make the regulation more palatable and logistically possible. WEAO is represented on this group by me and Ian McIlwham of Durham Region. We will keep you posted as this initiative develops.

The Long-Range Conference Planning Committee is busy planning the next 5-7 years. The 2011 conference will be held in Toronto, 2012 in Ottawa, and back to Toronto in 2013. We are trying to be in Toronto every other year and otherwise move the event around Ontario as we can. We are of such a size now that there are not many venues that can accommodate us. Unfortunately, the success of our conference does restrict our ability to get closer to northern parts of the province. We urge you to start planning for the 2011 conference, and, if you have a team that would like to participate in the Operations Challenge, let us know.
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Ronald Gehr
New Approaches in Wastewater Disinfection

he first point that Dr. Ronald Gehr makes about his research on wastewater disinfection is the importance of challenging assumptions. Unlike water treatment, in which the aim is to destroy all pathogenic microorganisms during the treatment process, a wastewater treatment plant (WWTP) aims to destroy or inactivate only to a certain target level. The assumption has been that, in a group of microorganisms, the ratio of harmful to innocuous will be the same in the original as in the final population.

“But maybe that is not the case,” challenges the environmental engineering specialist. “What happens if the pathogenic organisms are somehow more resistant to the disinfection process?”

In order to assess the true effectiveness of any disinfectant, he has turned to using gene analysis rather than the traditional indicator organism method. By identifying the actual virulence of a sample, Gehr and his colleagues hope to assess both the safety and accuracy of the samples that operators are taking and culturing in their on-site laboratories.

This is one of two areas of research that Gehr is pursuing as the Director of McGill’s Environmental Engineering Laboratory. It is an issue that goes to the very heart of wastewater disinfection: the need to provide humans with a reasonable degree of protection from contact with pathogenic organisms such as those that cause gastroenteritis, polio, typhoid, and a number of different viral and parasitic diseases.

Fittingly, the other preoccupation of wastewater treatment – protecting aquatic life from the very disinfectants that control microorganisms – is his other area of concern. It is a delicate balancing act. Chlorine, still the most widely used wastewater disinfectant, can kill fish and aquatic life if found in concentrations of more than 0.002 mg per litre. For this reason, the amount of chlorine added during the disinfection process must be carefully monitored; if the chlorine concentration is too high at the point of discharge, the WWTP must de-chlorinate.

“Then the operation becomes quite complicated and much more expensive,” notes Gehr. As a result, there has been a growing interest in alternative disinfectants. Over the past 20 years, Dr. Gehr has conducted research into disinfection of wastewater using UV, ozone, peracetic acid (PAA), performic acid (PFA), or a combination of these.

Peracetic acid, for instance, is used as a disinfectant in hospitals and as a bleaching agent by the pulp and paper industry. “Here is something used for de-chlorinating, for example, and de-chlorination,” he says. “And it is much simpler.”

Gehr’s laboratory was one of the first in Canada to perform collimated beam testing for UV disinfection and regularly performs these tests for municipalities across North America. “For a brand new treatment plant, it may be cheaper or the same price to install UV than to have chlorination and dechlorination,” he says. “And it is much simpler.”

However, although UV is very effective at inactivating bacteria and viruses, it has tremendous problems disinfecting particles. This is why some municipalities have been discussing the possibility of using a combination of disinfectants in the treatment process. “Just as with drinking water, we are now talking about multi-barrier systems,” notes Gehr. In his research, he has been looking at the efficacy of combining UV and peracetic acid, a mild disinfectant with no toxicity or significant by-products.

A long-time concern in the water treatment industry, disinfection by-products (DBPs) have only recently come onto the radar in wastewater treatment. “People started worrying not only about the effect of DBPs on humans, but also on aquatic life,” says Gehr. “Then there is the fact that, in many cases, cities are also taking their drinking water downstream from the discharge of the WWTP.”

This situation has further implications. Scientists and regulators are now concerned about a newly-identified phenomenon: the presence of pharmaceuticals, personal care products and pesticides, introduced by humans into the wastewater, and their interaction with chlorine.

“Now we have ‘new’ DBP precursors,” explains Gehr. “We are gaining more knowledge every week about this...
second generation of DBPs. But, regardless of whether there is chlorine or not, the precursors in and of themselves are a problem and need to be removed.”

The question is whether one product, technique or process can do this while disinfecting at the same time. In the lab, ozone is very effective in breaking down these micro-pollutants and Montreal is hoping to have good results. The only drawback is that ozone is an extremely costly process.

Gehr is currently doing research with bromine to see if this potentially more cost-effective and readily-available chemical might address both disinfection and micro-pollutant removal.

Measurement accuracy is another important issue when it comes to residual chlorine in treated wastewaters. Increasingly, online automated systems are replacing manual post-treatment sampling. Although the amperometric method is the gold standard for measuring chlorine levels in the laboratory, it is affected by pH, flow and pressure fluctuations. Hence, its online application has limited use in WWTPs.

On the other hand, the DPD method, whereby a pump automatically takes a small sample, adds reagents and measures the resulting colour, is more reliable. “The fact that it requires reagents means that it is a little more complicated to operate,” notes Gehr, adding that, although small, the samples should be handled as a separate waste stream.

Both methods measure residual chlorine after treatment so that, if levels are too high, de-chlorination is still required. However, there is a newer method that can be used in a predictive capacity.

“Oxidation reduction potential (ORP) can tell you in advance if you will need more or less chlorine during treatment,” explains Gehr. Because chlorine oxidizes as well as disinfects, by measuring the oxidation potential of the inflow, this system can determine the dosage necessary so that just enough chlorine will remain for disinfection. This helps reduce the presence of residual chlorine and the necessity for de-chlorination.

Gehr points out that, although automated, an ORP system still involves training and education. He adds that, even with an ORP system, DPD would still be required in order to keep a record of chlorine levels, a necessity for meeting regulatory requirements. Nonetheless, Gehr sees ORP technology as playing a significant role in the future of disinfection. “It saves a lot of money and allows for better control of disinfection,” he notes.

Streamlining the disinfection process and improving its efficacy is an ongoing pursuit for the professor and one that continues to have a direct impact on the industry. As such, he divides his time between research and teaching in the areas of water and wastewater treatment processes, aquatic chemistry and water and wastewater analysis. He has given courses around the world, including South Africa, Mexico, Australia and Israel. As a Professional Engineer, Gehr has consulted on projects for the cities of Saskatoon, Winnipeg and Vancouver, as well as several municipalities in Ontario and Quebec. Once again, his work demonstrates that, in the field of wastewater treatment, research and practice go hand-in-hand.
The October 29 deadline for the WEAO Scholarship Program is quickly approaching. The WEAO Scholarship Program was established in 2007 to promote student awareness of, and recognize outstanding students in, the water quality field in Ontario. The scholarships support promising students who are pursuing careers that protect water quality, including wastewater treatment and watershed management.

Past scholarship winner Alvin Pilobello had this to say about his experience: “Through the literature research and talking to my supervisors and teachers, I gained a broader understanding of why I was pursuing a water environment career. The WEAO Scholarship Award was valuable to me as a student and the recognition helped me with my job search after graduation.”

The 2010 scholarships will include four awards. There will be one award of $2,000 and three awards of $1,000 each. One award is reserved for a college student and one for a university student. To be eligible, applicants must be attending an Ontario college or university on a full-time basis, be a member of the Water Environment Federation (WEF) and/or Water Environment Association of Ontario, and have not received the scholarship previously.

Entry requirements include a completed application form, two completed reference forms, and a 500 word essay. The essay must describe a technical issue related to wastewater treatment and/or water pollution control that, in the opinion of the applicant, is important for the protection of water quality in Ontario. Application forms and complete entry requirements are posted on the scholarship website: www.weao.org/scholarship. Any questions about the Scholarship Program can be directed to scholarship@weao.org.

Good luck to all applicants.

I gained a broader understanding of why I was pursuing a water environment career.

WEAO NP AND OWWA YP SUMMER SOCIAL

Kathleen Hum, CH2M HILL

What could be better than a beautiful relaxing summer afternoon on the patio, with some great food and company? Of course, the opportunity to tour a national historic civil engineering site, that happens to be a water treatment plant would be a great addition, now wouldn’t it? On July 17, the annual Summer Social was held at Lion on the Beach, in downtown Toronto. This was an event jointly hosted by the Ontario Water Works Association (OWWA) Young Professionals and the WEAO New Professionals (NPs). The Summer Social was preceded by an educational and insightful tour of the City of Toronto’s R.C. Harris Water Treatment Plant, organized by the OWWA Young Professionals. This social event provides an opportunity for networking among students and new and young professionals, in an informal and relaxed environment. Fun and lively discussions were had on a number of topics, ranging from the morning’s tour, to the upcoming WEAO and NP events planned for the next few months, from interesting local events to abstract submissions, for the next WEAO conference. All in all, the Summer Social was a terrific day complete with delicious food, excellent weather, and energetic company.

Thanks are extended to the team of Mark Ortiz (City of Toronto), Laurie Belgrave Sookhoo (Genivar), and Tina Zhang (Genivar) for organizing this great event.

WEAO New Professionals, Students from Student Chapters, and OWWA Young Professionals enjoyed a beautiful day with a morning tour followed by the annual Summer Social.
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WEAO STUDENT DESIGN COMPETITION: A GREAT OPPORTUNITY TO BRIDGE SCHOOL AND THE REAL WORLD

Rafiq Qutub, AECOM, WEAO Student Design Competition Sub-Committee Chair

A hallmark of the water environment professional is the ability to apply scientific principles to solve environmental challenges. Students in colleges and universities learn many scientific principles, but rarely get the opportunity to apply them while in school. Hence, students’ learning experience would be significantly enhanced if theoretical knowledge is complimented with real world application.

The Student Design Competition (SDC) is intended to do just that: providing students with the opportunity to apply their environmental skills to a real world challenge. In addition, the SDC offers a valuable networking opportunity to interact with consultants, equipment suppliers and municipalities. Developing a professional network is equally important for prospective professionals in the water environment industry.

The original SDC concept was based on a student competition held within the Florida Water Environment Association. The SDC has since expanded to various Water Environment Federation Member Associations across the US and has become an annual event at WEFTEC, the Water Environment Federation’s Annual Technical Exhibition and Conference.

The WEAO New Professionals Committee organized the first SDC in 2008. The design challenge for the first competition was kindly provided by the Regional Municipality of Durham. The challenge involved the design of a replacement sewage pumping station and forcemain in the City of Pickering. The University of Toronto won first place in Ontario and was the first Ontario team to participate at the WEFTEC SDC in Orlando, Florida in October 2009. The University of Toronto team scored second place overall against nine teams from across the US.

Earlier this year, at the 39th Annual WEAO Technical Symposium and OPCEA Exhibition in London, student teams from five Ontario universities competed at the second annual SDC. The design challenge was again provided by the Regional Municipality of Durham. The challenge involved the design of an expansion to the Port Darlington Water Pollution Control Plant, which services the Bowmanville urban area. The scope of the project included the design of secondary treatment, effluent disinfection, and biosolids handling. Ryerson University won first place and the team is receiving WEAO’s sponsorship, to compete at the upcoming WEFTEC SDC in New Orleans, Louisiana in October. We wish them all the best.

The third annual WEAO SDC will be officially announced, in September 2010, to students in colleges and universities across Ontario. The design challenge for this year is kindly provided by the Regional Municipality of Halton. The challenge involves the design of an expansion to the Acton Wastewater Treatment Plant in the town of Halton Hills. The project is currently undergoing a Schedule ‘C’ Class Environmental Assessment, to assess alternative design concepts and address current and future development within the area. The design solution should provide adequate treatment and maintain water quality in the environmentally-sensitive Black Creek.

Participating teams will be required to review background information, evaluate potential alternatives, develop conceptual design ideas, and present a program meeting the requirements of the design challenge. Participating teams will deliver their design presentations to a panel of judges, at the 40th Annual WEAO Technical Symposium and OPCEA Exhibition, which will be held in Toronto, in April 2011. The first place winner will receive WEAO’s sponsorship to compete at the next WEFTEC SDC. Second and third place teams will receive recognition plaques and monetary awards.

The SDC is open to all college and university students who are student members of WEF. Interested students are encouraged to visit the SDC website at www.weao.org/sdc to obtain more information on the upcoming competition.

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Ashbridges Bay Wastewater Treatment Plant (WWTP) was host to the latest WEAO New Professionals (NP) facility tour, on the morning of Saturday, June 19, 2010. Ashbridges Bay WWTP is an 818-MLD facility that currently treats the wastewater from the City of Toronto, and serves an equivalent population of approximately 1.5 million people. Over recent decades, the City of Toronto has experienced significant growth and as such, so has its WWTP, which is undergoing upgrades at various treatment processes. Since Ashbridges Bay is a conventional activated sludge facility that discharges to Lake Ontario, the effluent must be of the highest quality.

The tour, given by Ian Smith of the City of Toronto, covered most areas of the plant. Ian explained all components of the plant in great detail and knowledgeable commentary. The tour of the liquids side of the plant started at the inlet sewers and progressed through the plant to preliminary treatment, primary treatment and secondary treatment. The tour then moved to the solids building where Ian showed tour participants the solids thickening and dewatering processes, as well as the biosolids truck loading facility.

The tour then moved to the pelletizer facility, operated under contract by Veolia Water. Veolia’s Ed Monk showed tour participants around the many levels of the pelletizer facility and explained how the biosolids generated at the plant are processed to become pellets. Biosolids generated at the plant are managed in a number of ways; including many types of beneficial use applications and landfilling. The pelletization facility began the commissioning phase in 2008.

The WEAO NP Committee would like to extend thanks to our tour guides, Ian Smith and Ed Monk, for their time in showing us how the ABTP operates, as well as Mark Ortiz of the City of Toronto, who made it possible for this tour to take place. Also, we would like to thank the over 25 students and NPs who joined us on a Saturday morning, to further their wastewater knowledge.

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UV solutions for water scarcity


Water scarcity is a growing issue in many regions around the globe. Many cities, large and small, are experiencing water stress in the form of deterioration in water quality and growing shortage in water quantity. Reuse of treated municipal wastewater offers an attractive solution to water stress. The treated wastewater can be reused for the purpose of irrigation, landscaping, toilet flushing, car washing or industrial use. There is also a growing trend towards indirect potable reuse of wastewater. Around the world, a number of indirect potable reuse (IPR) projects have been successfully implemented and more are in progress to reuse wastewater to protect and augment potable supplies. In all these applications, wastewater reuse helps to relieve the burden on existing municipal potable supplies. Since people may be in contact with reused wastewater, its proper treatment is critical for ensuring public health protection. The use of ultraviolet (UV) technology has been successfully implemented for the purpose of providing disinfection and environmental contaminant treatment (ECT) in water reuse applications.

Disinfection for water reuse
Chlorine is often used for disinfection of wastewater for reuse purposes, but there are two main risks associated with chlorine disinfection. First, it has been well established in literature that chlorine disinfection forms by-products, such as THMs, HAAs and NDMA. These by-products can cause both acute and long-term health effects. Second, chlorine is ineffective at disinfecting the illness-causing protozoa, Cryptosporidium. In many parts of the world, Cryptosporidium is commonly found in municipal wastewater, even after conventional treatment.

UV disinfection of wastewater for reuse purposes has been successfully applied for decades in large scale treatment plants in North America and around the world. Reuse water is wastewater that has been treated to high standards in order to protect public health and to ensure environmental sustainability. Reuse water is typically treated to tertiary levels using sand filtration or membrane filtration prior to disinfection by a UV system.

Both open channel (gravity flow) and closed vessel (pressurized) UV systems are currently used in reuse applications. Open channel reactors are often installed in existing chlorine contact chambers, thereby eliminating the need for major civil work, thus reducing installation costs. Furthermore, the open channel configuration provides a complete disinfection system with minimal headloss, thus, there is virtually no impact on the existing plant hydraulics (Figure 1).

With the increased use of membrane bioreactors to provide high-quality treated water for reuse applications, many plants are producing pressurized effluent, which needs to be disinfected. Instead of ‘breaking head’ and re-pumping, an alternative is to install a closed vessel UV system for disinfection (Figure 2).

Chemical contaminant treatment with UV-oxidation
Beyond general water reuse for irrigation or non-potable uses, there is a growing trend toward indirect (IPR) or direct potable reuse (DPR) of wastewater. The term ‘indirect potable reuse’ denotes injecting treated water into groundwater aquifers or releasing it into surface water reservoirs for future withdrawal, while ‘direct potable reuse’ describes the direct use of highly-purified wastewater directly for drinking. An obstacle to the potable use (both indirect and direct) of this water has been the presence of chemical and biological contaminants not easily removed by conventional treatment processes.

Worldwide, a number of plants that are performing IPR utilize a treatment train that consists of membranes
(typically, microfiltration and reverse osmosis) followed by UV-oxidation. Within a UV system designed to perform UV-oxidation, two processes occur to treat chemical contaminants found in reuse water: UV-photolysis and UV-oxidation. UV-photolysis is the process by which chemical bonds of the contaminants are broken by the energy associated with UV light. UV-oxidation systems rely on the generation of hydroxyl radicals by way of the UV-photolysis of hydrogen peroxide and the subsequent oxidation of chemical contaminants by those hydroxyl radicals. Hydroxyl radicals have a higher oxidation potential compared to other oxidants like ozone and chlorine. However, unlike those oxidants, the hydroxyl radicals are extremely reactive and short-lived and do not exist beyond the boundaries of the UV reactor. The combination of UV-photolysis and UV-oxidation allows for the destruction of chemical contaminants that can be present in reuse water. The UV-oxidation reaction is illustrated in Figure 3.

A large UV-oxidation application is the Groundwater Replenishment System (GWR), an IPR project located at the Orange County Water District (OCWD) in Fountain Valley, California. In early 2009, OCWD placed into operation a facility that will purify a peak flow of 100 MGD of wastewater for distribution into area spreading basins and injection into local aquifers (to prevent seawater intrusion). This project is the largest IPR project in the world and consists of microfiltration (MF) and reverse osmosis (RO), followed by a UV oxidation/disinfection system (Figure 4).

While MF and RO provide treatment for a variety of organic compounds, there are a number of contaminants that, due to their small molecular size, can pass through even the most advanced RO membranes. Common in wastewater, a compound known as N-nitrosodimethylamine (NDMA) is present at the GWR system as a byproduct formed during upstream wastewater treatment processes. The treatment objectives accomplished by the UV-oxidation system include:

- destruction of nitrosamines and other contaminants treated by UV-photolysis (UV alone)
- destruction of pharmaceuticals, personal care products and industrial chemicals treated by UV-oxidation (UV + hydrogen peroxide)
- microbial disinfection
- additional protection, i.e., an additional barrier that helps build public confidence in treated water.

A sustainable source of water

In North America, especially in the southern and western states, urban centers are experiencing decreasing ground water tables, land subsidence, saltwater intrusion and chemical pollution. Reuse of wastewater, now recognized as an ecological and economic necessity, is increasingly practiced, not only in the United States, but globally as well in water scarce regions such as Australia, Italy, Spain and Portugal. For the past two decades, and more so today, ultraviolet treatment has been successfully used to disinfect reuse effluents and provide contaminant destruction. UV is a proven technology for wastewater reuse that can protect the public against pathogenic microorganisms and chemical contaminants. As an alternative to other methods of treatment, UV in water reuse applications does not produce harmful by-products, is non-toxic to the environment, and is energy efficient. The use of UV-oxidation in IPR and DPR applications destroys chemical contaminants that may pass through MF and RO membranes and ensures that recycled water meets or exceeds drinking water standards.

All images and photos are courtesy of Trojan Technologies (www.trojanuv.com). More information about UV disinfection and UV-oxidation is available on the Trojan Technologies website: www.trojanuv.com.

Figure 3: The UV-oxidation process requires the combination of UV and hydrogen peroxide, which forms hydroxyl radicals (red and white). The hydroxyl radicals rapidly react with chemical contaminants (in yellow) within the UV reactor.

Figure 4: The Orange County Water District’s 100 MGD Groundwater Replenishment System employs UV-oxidation as a final barrier for pathogens, nitrosamines, pharmaceuticals, industrial chemicals and other contaminants. The resulting treated water exceeds drinking water standards and is injected into local aquifers for eventual potable reuse.
Conversion from chlorination to UV disinfection at the Orillia wastewater treatment centre: challenges and solutions

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Introduction
Inorganic chloramines and chlorinated wastewater effluents were found to be toxic under Section 64 of CEPA 1999 and were added to the List of Toxic Substances, Schedule 1 of CEPA 1999. The use of chlorine for the disinfection of municipal wastewaters has led to the proliferation of chlorinated wastewater effluent released to receiving waters. Residual chlorine is toxic and has been shown to have a negative impact on the fish and other aquatic fauna exposed to it. As a result, the City of Orillia was required to prepare and implement a Pollution Prevention (P2) Plan as set out by the P2 Planning Notice published by Environment Canada in December 2004 entitled: P2 Planning Notice Requiring the Preparation and Implementation of Pollution Prevention Plans for Inorganic Chloramines and Chlorinated Wastewater Effluents. The objective of the P2 Plan, as it applied to the City of Orillia, was to reduce the quantity of inorganic chloramines and chlorinated wastewater effluents. These will be monitored as Total Residual Chlorine (TRC) in the effluent discharged from the Wastewater Treatment Centre, to below 0.02 mg/L.

Project background
The Orillia Wastewater Treatment Centre (WWTC), a conventional secondary treatment, activated sludge plant, has a rated average daily capacity of 27,000 m³/day and a peak flow rate of 72,700 m³/day. The plant’s original design included effluent disinfection with chlorine, in a four-channel chlorine contact chamber, prior to discharge to Lake Simcoe via Ben’s Ditch. During chlorination, the concentration of total residual chlorine in the treated effluent was averaging around 0.30 mg/L, with maximum values reaching as high as 0.65 mg/L – well above Environment Canada’s stipulated maximum total residual chlorine level of 0.02 mg/L.

To comply with Environment Canada’s requirements, it was necessary either to dechlorinate the effluent or use another form of effluent disinfection. After evaluating a number of possible alternative solutions, the City of Orillia identified UV irradiation as the best option to disinfect the wastewater effluent.

The major challenges faced by this project were tight hydraulic conditions, approval of discharge of non-disinfected effluent during the construction period, and a short window of time available for construction of the new UV disinfection system.

Design challenges
In 2006, the City of Orillia retained R.V. Anderson Associates Limited to carry out design of the UV disinfection system and contract administration of the construction phase of the project. One of the biggest challenges that had to be resolved by the design team was related to tight hydraulic conditions at the Orillia WWTC, as only approximately 0.3 m of hydraulic head was available for the UV disinfection system. However, a typical UV disinfection system requires approximately 0.9 m of water level drop to accommodate a ‘standard’ water level controller required to regulate a water level above the UV lamps. This ‘hydraulic head’ issue had to be taken into consideration in evaluation of design alternatives of the UV disinfection facility at the Orillia WWTC.

The two basic alternatives that were identified at the conceptual design stage included construction of a stand-alone ‘UV disinfection’ building (option A) and installation of the UV disinfection system in the existing chlorine contact chamber (option B).

The major advantage of option A was the minimal interference with the operation of the existing disinfection system during construction. At the same time, it was identified that this option was significantly more expensive to construct (due to a need for modifications to the existing effluent channels and the outfall and an effluent lift pumping station) and to operate (due to additional operations and maintenance costs for the operation of the effluent lift pumping station). Option B, however, did not require any modifications to the effluent channels, and the UV system could be installed in the existing chlorine contact chamber, after some minor modifications. Also, with this option, the UV disinfection building could be constructed on the top of the chlorine contact chamber, resulting in significant capital cost savings. From this point of view, option B was the clear leader, as long as the hydraulic head issue was resolved.

A solution to the hydraulic head issue was found in eliminating the standard UV system’s water level controller and replacing the existing fixed effluent...
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weir with a weir gate, which would not only regulate the water level in the UV channel, but also measure the final effluent flow at the same time.

Approvals
Another challenge associated with option B was related to a need for interruption of the existing chlorination system, during construction of a new UV disinfection system. Permissions from the MOE and the local Health Unit were required for discharging the final effluent without disinfection, during the construction period.

This issue was discussed with the MOE Central Region, Barrie District Office and the Simcoe Muskoka District Health Unit early in the design phase. Both authorities agreed to the proposed request and allowed discharge of non-disinfected effluent to Lake Simcoe, during the off-season period from October 16, 2007 to January 31, 2008. This decision was mainly based on the assumption that recreational water quality use did not begin until May 24, with heavy use largely restricted to July and August. This allowed a buffer period, greater than the accepted three months required for water quality protection that would allow adequate time for natural breakdown of sewage pathogens to reduce the health risk from body-contact human exposure.

At the same time, MOE imposed additional sampling and reporting requirements during this ‘non-disinfection’ period. They requested collection of daily bacteriological samples, including E.Coli, at locations upstream and downstream from the plant. The MOE also required reporting to the District Office on a weekly basis with a written assessment of any noticeable environmental impacts to Ben’s Ditch and/or Lake Simcoe.

Construction
The very short period during which the MOE allowed bypassing of the existing chlorination system, presented another challenge. To comply with the MOE’s requirement, the tender documents were drafted such that a contractor was allowed to bypass the chlorine contact tank only from October 16, 2007 to January 31, 2008, by which time the new UV disinfection system was to be built, tested, commissioned, and running.

The construction contract of the UV disinfection system was awarded to Peak Engineering & Construction Ltd. in July 2007. To accommodate this time constraint, the general contractor proposed a plan to construct a new concrete slab over the existing chlorine contact chamber well in advance of October 16, 2007, while keeping the chamber in service. Their plan was to begin building the slab early in September 2007 and complete it and be ready for work inside the chlorine contact chamber by October 16, 2007.

After putting all contingency procedures in place, the proposed construction plan was executed flawlessly, and the slab was successfully completed by October 16, 2007. Then, during the following 3.5 months, the contractor completed all modifications within the chlorine contact chamber, built the UV disinfection building, and brought the UV disinfection system into operation by the end of January 2008.

Summary
Providing a weir gate in place of the standard water level controller for the UV system and a fixed weir proved to be an effective and economical solution to addressing the problem of tight hydraulic conditions at the Orillia Wastewater Treatment Centre. In addition, working in close coordination with the MOE Central Region Barrie District Office and the Simcoe Muskoka District Health Unit, combined with the contractor’s aggressive construction schedule, helped to ensure an on-time and on-budget project.

The new UV disinfection system, which has been in operation since February 2008, is not only providing reliable disinfection of the Orillia WWTC final effluent, but also has eliminated the discharge of about 1,600 kg/year of chlorine into Lake Simcoe.
Chlorine and dechlorination – options for design and control

Matt Woodbeck M.A.Sc., P.Eng., Ignatius Ip, P.Eng., Troy Briggs M.Eng., P.Eng., AECOM

Chlorine is the most widely used disinfectant in Ontario’s wastewater treatment plants. Recent regulations associated with the Canadian Environmental Protection Act (CEPA) required most wastewater system owners to develop Pollution Prevention Plans outlining the steps that would be taken to reduce effluent chlorine levels to less than or equal to 0.02 mg/L. In order to meet this objective, a dechlorination step has been added to many systems, often utilizing sodium bisulphite.

Design concepts
The chlorination and dechlorination processes require sufficient contact volumes to adequately disinfect and dechlorinate effluent flows. If space constraints are not an owner concern, a chlorine contact tank (CCT) can be constructed to provide the necessary contact volume on the plant site before discharging to an outfall. All instrumentation can be installed in an accessible manner, allowing for relatively painless maintenance and calibration. The CCT has the benefit of providing direct, real-time onsite measurement of control parameters for the chlorination and dechlorination processes.

At some larger facilities, the outfall has historically been used to provide chlorine contact time. Space is at a premium at many of these facilities and constructing a new CCT may not be feasible. In these cases, it may be preferred to utilize the contact volume provided within the outfall to provide contact time for chlorination and add the dechlorination agent to the outfall upstream of the first diffuser. However, providing access for real-time instrumentation and direct sampling is not possible with this approach.

A solution to this challenge is to design an on-site simulator system that mimics the hydraulics of the outfall. Typically, the simulator is designed to be the same length, but of smaller diameter than the outfall. A representative effluent sample is then fed through the simulator to achieve the same chlorination and dechlorination contact times as the outfall. All desired instrumentation is installed along the simulator for continuous monitoring, which represents the change in effluent characteristics and parameters at different intervals along the outfall.

Feedback signals from the instruments on the simulator can be used to control chemical dosing to the outfall. This design will take up a much smaller footprint on the plant site, but can present some challenges as well. Care should be taken in ensuring that the best approximation possible of the outfall hydraulics is maintained. Also, the simulator design will result in more equipment and increased complexity for operations and maintenance compared to a traditional chlorine contact tank.

Control strategies
The selection of control strategies for the chlorination and dechlorination processes can have a significant impact on process efficiency and chemical consumption. A flow-paced control strategy can be operated easily with minor manual adjustments required to adjust dosages to monitored parameters such as E. coli or residual sulphite. A compound loop controller using both flow and residual feedback may be preferred for optimization of chemical usage. However, the relatively inherent delays and response time in these systems make it challenging to tune a traditional proportional-integral-derivative (PID) controller. Some success has been had with a modified step-change control strategy tailored to the slower response times.

Instrumentation
Several instrumentation options are available for chlorination and dechlorination control and monitoring. Chlorine residual analyzers are widely utilized with high levels of operator familiarity. Utilizing a chlorine residual analyzer for chlorination control can also have the added benefit of increasing the stability of the dosage for dechlorination, which is directly proportional to chlorine residual.

The objective chlorine residual of less than or equal to 0.02 mg/L, after dechlorination, is at or below the current lower limit of chlorine residual measurement technology. In order to address the analytical challenges of confirming a chlorine residual at this extremely low range, the Ontario Ministry of the Environment and Environment Canada have accepted the measurement of sulphite residual as a surrogate parameter to indicate the absence of chlorine residual. Sulphite residual analyzers can require increased maintenance, but they also provide the added benefit of allowing for control strategies based directly on the parameter that is acceptable for compliance monitoring.
Simulator Spools and Instrumentation at Humber Treatment Plant

Oxidation-reduction potential (ORP) analyzers have been utilized as an alternative method of assessing disinfectant efficacy. The analyzers are a probe type with low maintenance requirements and can easily be installed outdoors. ORP has been shown to correlate well with disinfection effectiveness, but does not always correlate with chlorine residual. As a result, compound loop control algorithms should be considered with the use of ORP analyzers. Dechlorination control based on ORP analyzers has also been used with success. However, additional off-line monitoring is required to confirm elimination of chlorine residuals, since ORP is not a recognized surrogate parameter to indicate elimination of chlorine residual in Ontario.

Summary

Many options are available for the design and control of chlorination and dechlorination processes. A site-specific solution depends on the existing infrastructure and site constraints. Due to the need to virtually eliminate chlorine residual, control strategies should be considered for both chlorination and dechlorination to reduce overall chemical usage and maintain system compliance over a wide range of operating conditions.
The use of ultraviolet light for improving water quality has developed into an essential tool for engineers and owners for improving water quality for the environment and for drinking water quality. Among the available water and wastewater treatment technologies, ultraviolet (UV) disinfection is a non-invasive chemical free method of improving water quality. With the use of UV as a treatment technology, both consumers and the environment can benefit from the potential improvements to water quality.

History
It is surprising that the application of UV light for disinfection purposes has been around for such a long time. The first drinking water disinfection application dates back to 1910 in Marseilles, France. However, the use of UV technology was generally avoided in the first half of the 20th century, as chlorine was considered comparatively more effective and inexpensive compared to UV disinfection.

During the second half of the 20th century, the use of UV disinfection for water treatment gained momentum. The first reliable application of UV light for disinfecting municipal drinking water occurred in 1955. By 1985, Switzerland and Austria had approximately 500 and 600 UV installations respectively for water treatment. Around the same time, Norway and the Netherlands began to implement UV technology for water treatment in response to the concerns of the potential generation of disinfection by-products from the use of chlorine. Also, more recently, UV technology is now recognized as an effective means for neutralizing cryptosporidium in water treatment.

During the 1980s, the technology began to develop for the municipal wastewater market and grew through-out the 1990s and into the 21st century. The impetus for much of this growth was to avoid the handling and storage of chemicals, and to eliminate toxicity associated with residual chlorine in the environment.

An important benchmark to this growth in UV technology is the New York City Catskill/Delaware Facility presently being constructed. This facility will be the largest UV disinfection system in the world, with a total treatment capacity of 8,300 ML/day (2.2 billion gallons a day).

UV disinfection fundamentals
Ultraviolet light is able to inactivate microorganisms because it damages the DNA or RNA of microorganisms. As a result, microorganisms are unable to replicate, and are effectively neutralized, as they can no longer infect a host. Thus, the UV light does not, in fact, ‘kill’ the microorganism, but rather ‘inactivates’ the microorganism.

It has been shown that the germicidal effect of UV light is in the 200-300 nm (nanometre) range. Depicted below is the typical absorbance of UV light for thymine, which is a base acid in DNA.

Thymine is ‘altered’ by UV light in DNA, and thymine’s absorbance by UV light is used as an indicator of the microorganism neutralizing capability of UV light.

UV technology applications
The use of ultraviolet disinfection technology as applied to water and wastewater treatment is primarily for disinfection purposes. However, its applications can be more broadly described in the following categories:

- Water treatment as a primary disinfectant – Chlorine is still used as a secondary disinfectant in water distribution systems. UV is particularly effective for specific microorganisms (i.e., giardia and cryptosporidium).
- Enhanced water treatment applications to remove specific compounds – Taste and odour compounds can be removed using UV with chemical oxidation. This process usually uses hydrogen peroxide as an oxidant,
which is ‘activated’ with the energy from UV light.

- Wastewater treatment for disinfection prior to effluent discharge to the environment – Typically, UV treated effluent has no chlorine in it which is a benefit to the environment. This is particularly important to meet developing government initiatives to remove all residual chlorine from treated wastewater effluent in Canada under the CCME1 strategy.

- Enhanced wastewater treatment applications – UV technology has been used as part of a ‘multi-barrier’ microorganism removal strategy to reuse wastewater effluent. Wastewater effluent reuse has been gaining momentum as a necessary strategy to manage water supplies to burgeoning populations. Also, UV combined with chemical oxidation has the potential to remove emerging micro-contaminants such as pharmaceuticals, personal care products (PPCPs) and endocrine disrupting compounds (EDCs).

- Groundwater remediation and removal of persistent contaminants through the use of UV oxidation. Therefore, there is a diversity of applications for UV technology that continues to grow.

UV lamp types and reactor configurations

Ultraviolet light is applied through the use of mercury vapour UV lamps immersed in water or wastewater. In the lamp, inert argon gas atoms are brought into a state of excitation through an electric arc. The argon atoms collide with mercury vapour atoms which then emit UV light. There are a number of different types of UV lamps available:

- Low-pressure (LP) lamps – These lamps operate at an internal pressure of 0.13-1.3 Pa (2 x 10-5 to 2 x 10-4 psi) and electrical input of 50-150 W/cm. This results in a polychromatic (or broad spectrum) output of UV and visible light at multiple wavelengths, including wavelengths in the germicidal range.

- Low-pressure high-output (LPHO) lamps – These lamps also operate using a low-pressure mercury-vapor lamp, but have increased electrical input (1.5-10 W/cm), resulting in a higher UV intensity than low-pressure lamps. It also has essentially monochromatic light output at 254 nm wavelength.

- Medium-pressure (MP) lamps – These lamps operate at an internal pressure of 1.3 and 13,000 Pa (2-200 psi) and electrical input of 50-150 W/cm. This results in a polychromatic (or broad spectrum) output of UV and visible light at multiple wavelengths, including wavelengths in the germicidal range.

The following figure illustrates the different UV spectra for the low pressure monochromatic UV lamps and the medium pressure polychromatic UV lamps.

In general, both lamp styles are effective for specific applications. The low pressure lamps have better efficiencies because of their monochromatic output when compared to medium pressure lamps. However, where higher UV doses are required to be delivered, medium pressure lamps are preferred as they can deliver the required dose with far fewer UV lamps. This is an obvious advantage for large flow systems, or where higher UV doses are necessary, such as in drinking water applications and UV oxidation applications.

UV lamps and reactors are generally provided commercially in one of two configurations:
- Open channel reactors
- Enclosed pressure rated reactors

These configurations allow UV technology to be used in many applications.

Sizing UV systems

UV dose

The energy required to inactivate a microorganism is termed the UV dose and is measured in mJ/cm², or mW.s/cm². UV dose is defined as being the amount of UV energy at 254 nm reaching the organism (the intensity) multiplied by the contact time as follows:

\[
\text{Dose} = \text{Average intensity} \times \text{contact time} \quad (\text{e.g., mW/cm²}) \times \text{contact time} \quad (\text{e.g., seconds})
\]

The required UV dose depends on the application and the required performance parameters. In Ontario, the following provides some boundary conditions for developing the required UV dose:

- For secondary wastewater effluent use, a minimum 30 mJ/cm² dose at
must be in place to manage this condition. Effective cleaning mechanisms with algae, or oil and grease. Thereupon, fouling.

- Lamps may become coated with mineral or scale when compared to low pressure lamps, they are more prone to mineral and iron-organic complexes on lamps. Over time, lamps exposed to water and wastewater will coat with mineral fouling. Fouling (scaling) of UV lamps

- For wastewater effluent, the process should be limited to a high quality effluent having at least 65% ultraviolet radiation transmittance (UVT) at 254 nm (10 State Recommended Standards for Wastewater Facilities). ‘Safe’ design UVTs for wastewater effluent can be in the range of 55-65%.

- For water systems, ‘safe’ design UVTs can be in the range of 75-90%. Higher UV doses will most likely be required where dissolved iron exceeds 0.3 mg/L, dissolved manganese exceeds 0.05 mg/L, and hardness exceeds 120 mg/L (10 State Recommended Standards for Water Works).

UV systems require periodic maintenance. UV lamps must be shielded for safe use to protect against exposure to high UV light doses. The ongoing cost of chemicals are not insignificant.

Comparison of UV disinfection and chemical disinfection (wastewater)

For wastewater applications, the above table describes the advantages and disadvantages of UV disinfection and chemical disinfection.

UV disinfection

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minimal chemical handling required (only for cleaning)</td>
<td>Power requirements for UV are not insignificant</td>
</tr>
<tr>
<td>No toxins discharged to environment</td>
<td>UV systems require scheduled replacement</td>
</tr>
<tr>
<td>No potential for chemical spills</td>
<td>UV lamps must be shielded for safe use to protect against exposure to high UV light doses</td>
</tr>
<tr>
<td>Reduced potential to form disinfection by-products</td>
<td>Power requirements for UV are not insignificant</td>
</tr>
</tbody>
</table>

Chemical disinfection with sodium hypochlorite and sodium bisulphite

<table>
<thead>
<tr>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical systems have relatively low maintenance requirements</td>
<td>The ongoing cost of chemicals are not insignificant</td>
</tr>
<tr>
<td>System control and monitoring is effective to ensure adequate disinfection, and removal of chlorine</td>
<td>There are hazards associated with handling and storage of chemicals</td>
</tr>
<tr>
<td>Sodium bisulphite will consume dissolved oxygen, and there is a risk that this could impact water quality</td>
<td>There is a risk of discharging residual chlorine to the environment</td>
</tr>
</tbody>
</table>

Conclusion

In summary, ultraviolet (UV) disinfection is a non-invasive chemical free method of improving water quality for both water and wastewater applications. With UV technology’s evolving uses and benefits, the application of UV as a treatment technology will continue to grow. Both consumers and the environment can benefit from the potential improvements to water quality from this technology.

End note

1 Canadian Council of Ministers of the Environment

References

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Peracetic acid with UV for wastewater disinfection

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Introduction
Chlorine has been used effectively in water and wastewater disinfection for the last century. However, even low levels of chlorinated wastewater effluent have been found to be toxic and mutagenic to aquatic life (Bull, 1985). Due to the drawbacks of residual chlorine in wastewater effluent, the Canadian Environmental Protection Act (CEPA) has introduced legislation that requires wastewater effluent to strive for a chlorine residual of 0.02mg/L or less. One option for achieving this low chlorine residual is to introduce a dechlorination step into the treatment process, which can neutralize the reactive chlorine to the less harmful chloride species. Another option would be to use an alternative disinfection method that does not require chlorine such as ozone, ultraviolet (UV) radiation or peracetic acid.

UV is well known for its capacity to destroy protozoa, bacteria and viruses. It has been used in North America for over 20 years for the disinfection of wastewater. UV disinfects by inactivation, where the DNA of the microbe is damaged to such a level that it can no longer replicate. The popularity of UV is associated with its relative simplicity, short contact times, and the elimination of dechlorination. The limitations of UV are associated with energy costs and applications in highly turbid waters where shielding of microbes may occur.

Peracetic acid (PAA) uses in wastewater effluent disinfection have been studied in recent years. PAA is a solution mixture of acetic acid, hydrogen peroxide, and peracetic acid. The advantages of PAA over chlorine include higher redox potential at 1.81 V (PAA) compared to 1.36 V (chlorine), shorter required contact times, and lack of pH dependence, whereas disadvantages include the pungent vinegar smell associated with the solution mixture, as well as the relatively higher cost of PAA compared to chlorine. With respect to cost comparisons, the higher oxidation potential of PAA results in a lower required dosage compared to chlorine, which, in turn, leads to lower overall chemical consumption. Using PAA instead of chlorine would also eliminate the dechlorination step along with its extra storage tank, pump and secondary chemical consumption. As production of PAA has increased in recent years, the cost has decreased (15% PAA Solution: $4.12/kg (2004), $2.20/kg (2007), $1.50/kg (2010), data courtesy of FMC Ltd), however, it is still recognized as a potentially limiting step and it may currently be best suited for smaller plants or on an intermittent use basis (such as a supplement to a UV system). In addition, PAA has been reported to be less toxic and mutagenic than chlorine (Ferraris, et al 2005). PAA appears to produce no significant disinfection by-products, unlike chlorine, although this is an area of continued research (Dell’Erba, et al 2007). PAA is commonly used in the food industry as a surface disinfectant and is in full-scale use in parts of Europe, most notably Italy, as a wastewater disinfectant (Caretti et al 2003, Kitis, 2004).

Test set-up
Using bench scale and prior pilot scale testing data, a full-scale PAA trial was developed at the Grimsby Wastewater Treatment Plant. The process layout for disinfection experiments is shown in Figure 1(a).

Figure 1(a) – Grimsby WWTP – process layout for disinfection experiments
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Treatment Plant, located in the Niagara Region alongside its UV disinfection system. The PAA was dosed into the wastewater stream at the secondary clarifier, providing approximately 1.5-3 minutes of contact time ahead of the UV system where additional disinfection occurred (see Figure 1(a), 1(b)).

Throughout the test, various dosages of PAA were used to supplement the UV treatment. The goal was to determine an effective PAA dosage under varying wastewater effluent conditions that would assist the UV system in reducing E.coli in the effluent to below the compliance limit of 200 CFU/100mL of E. Coli. This wastewater treatment plant was specifically targeted for testing due to seasonal difficulties with meeting E.coli compliance by the UV system alone.

To achieve accuracy and consistency, onsite grab sampling for E. Coli was conducted repeatedly throughout the trial using the IDEXX Colilert™ system. The Colilert system is a relatively simple test to conduct wherein E.coli positive sample wells fluoresce (see Figure 2) under UV light. The well samples produce a most probable number which is correlated to a CFU/100 mL value. More information on this technique can be found at http://www.idexx.com/water/. Samples were taken at the following three locations: secondary clarifier, before UV treatment and after UV treatment (effluent).

Additional testing was also done to see if PAA has any effect on pH, suspended solids, ammonia, total phosphorus, cBOD, TOC and COD of the wastewater, as well as aquatic toxicity sampling. The extra testing results concluded that PAA did not have an adverse affect on pH, suspended solids, ammonia, total phosphorus, or cBOD in the process. No adverse results were found with the toxicity testing which was conducted between 1-3 mg/L of PAA.

Results and discussion
The primary goal of this full-scale testing was to both assess PAA disinfection under short contact times and as a supplement to a UV disinfection system. The Grimsby Wastewater Treatment plant has a highly variable E.coli level in the wastewater before disinfection; ranging
from a geomean of 30,000-60,000 during the summer months and then increasing in the fall to a geomean of 70,000 to over 400,000, due to seasonal changes in the incoming raw wastewater quality. PAA dosages were tested between 0.5 and 4.0 mg/L with the most effective PAA dosages in the 1.5-3.5 mg/L range. PAA dosages below 1.5 mg/L were not found to result in consistent reduction in E.coli values, this is likely due to reaction with other organic constituents in the wastewater effluent. Figure 3 shows the PAA dosage versus PAA+UV. As anticipated, there is a general improvement in disinfection as the PAA dosage increases. The PAA+UV combined treatment performance also increases as PAA dosage increases. When comparing the less than 1mg/L PAA dosage to the 3 to 4mg/L dosage the higher PAA dosage yields a 1 log-removal improvement over the lower PAA dosage. This data suggests, as expected, that increasing the PAA dosage could enhance PAA disinfection and, consequently, enhance the PAA+UV combined disinfection.

Equally interesting and of importance is Figure 4, which shows the relationship between the E.coli values before and after disinfection with respect to the UV system and PAA+UV. The graph clearly shows that the UV system was capable of handling E.coli disinfection up to 100,000 cfu/100 mL, however that, at values higher than this, the UV system was not capable of meeting the effluent disinfection criteria. The supplement of the PAA to the UV at this point was able to maintain the plant within compliance when the plant experienced E.coli values ranging from 100,000-500,000. The PAA dosages used at this time ranged upwards of 4.0 mg/L.

The addition of PAA to the disinfection system at Grimsby WWTP helped reduce E.coli concentrations in the wastewater stream to levels that were handled effectively by the UV system. Furthermore, the combined PAA+UV treatment process was particularly effective for inflows that contained high concentrations of E.coli (100,000-500,000 CFU/100mL); when the UV system alone at this plant was not capable of meeting the disinfection criteria. PAA can be effectively used for wastewater disinfection through a wide range of influent quality, whereas UV alone may not be as effective at treating wastewater in which the E.coli concentration is high. Therefore, the PAA+UV combined treatment is capable of dealing with wastewater that contains higher E.coli concentration. This testing clearly demonstrated both the ability of PAA to disinfect wastewater in short time periods as well as in complement to an existing UV system.

Acknowledgments
All testing was conducted with Niagara Region Public Works Department, Water and Wastewater Division. Special thanks go out to Randy Friesen, Chris Gatchene and Jason Oatley from the Niagara Region for their generous support and help with this project.

References

Figure 3 – Comparison of PAA and PAA+UV disinfection
Figure 4 – Comparison of E.coli before and after disinfection with UV and PAA+UV
Membrane bioreactors (MBRs) are activated sludge systems that employ ultrafiltration (UF) or microfiltration (MF) membranes instead of secondary clarifiers to separate treated effluent from the return sludge. By incorporating membranes, the quality of the treated effluent is equivalent to that of a conventional activated sludge plant, followed by membrane tertiary filtration – in other words a superb tertiary effluent. Meanwhile, the UF or MF membranes are comparable to those used for potable water treatment, and, in that application, a level of pathogen removal performance is assumed. Based upon the above, there could be capital and operating cost savings if MBRs were shown to provide a disinfection function by potentially reducing or eliminating downstream disinfection systems. This article will separate the anecdotal information from the facts.

Anecdotal information flows freely within the MBR community, and each has a grain of truth. Some MBRs having disinfection permit limits of 150-200 coliforms per 100 mL have met those limits downstream of the MBR, but upstream of their effluent disinfection system. Some of those plants operate their UV disinfection systems at partial power levels, more so to address pathogen concentration variations than to further reduce pathogen concentrations.

However, factual information supporting a disinfection function is limited. The one exception is the recognition by the National Water Research Institute (NWRI) that membrane-treated effluents can be considered to have a higher transmissivity than granular media filtration, on the order of 65% instead of 55%. This reduces the size and power output required for ultraviolet (UV) disinfection after MBRs.

Disinfection regulations

First and foremost, we must consider the context of disinfection and what it means in different jurisdictions. In many parts of North America, the disinfection requirements are typically based on California State Code of Regulation (CCR) - Title 22, 10 State Standards, or other state or provincial requirements. Those local regulations may require only 200 fecal coliforms per 100 mL, making the determination of any disinfection function by MBRs a valuable consideration.

CCR - Title 22 regulations set a more structured approach toward water reclamation, and are followed in some parts of North America as a benchmark for health standards as well as technology implementation. CCR - Title 22 regulations provide prescribed rules for approved filtration technologies, with membrane filtration being required to maintain a high effluent quality not exceeding 0.2 nephelometric turbidity units (NTU) more than 5% of the time within a 24-hour period and 0.5 NTU at any time.

The CCR - Title 22 regulations also prescribe disinfection requirements for wastewater reclamation using UV, chlorine, or alternative disinfection technologies, when combined with filtration, to have a demonstrated performance to achieve 5-log inactivation of viruses. The regulations require a minimum chlorine concentration X contact time (CT-value) of 450 mg-min/L to achieve 4-log virus reduction.
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Cold Climate Effluent Quality

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOD/TSS</td>
<td>&lt;5 mg/L</td>
</tr>
<tr>
<td>Total Phosphorous</td>
<td>&lt;0.5 mg/L</td>
</tr>
<tr>
<td>Total Ammonia</td>
<td>&lt;1 mg/L</td>
</tr>
</tbody>
</table>

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and a 7-day median total coliform limit of 2.2 MPN/100 mL for disinfection of filtered secondary effluent for unrestricted use. For disinfection with UV, the regulations rely on the National Water Research Institute (NWRI) UV Disinfection Guidelines. The NWRI/AwwaRF UV Guidelines (2003) were developed to facilitate design and commissioning of UV disinfection systems, and to provide a methodology that can be used to validate UV disinfection system performance. The regulations call for a design UV dose of 100 mJ/cm² and 80 mJ/cm² for media filtration and membrane filtration systems, respectively. The regulations also call for a design ultraviolet light transmittance (UVT) value of 55% and 65% for media filtration and membrane filtration systems, respectively.

The disinfection mechanism using MBRs

Pathogen removal through filtration systems depends on size exclusion and particle attachment, and, therefore, pathogen removal through membrane filtration would, in part, greatly depend on membrane structure, pore size, size and shape of the organism. Although we are not aware of any published studies showing both pathogen data in MBR effluents, as well as effluent quality data (e.g., turbidity), such data is available from well operated tertiary filtration systems. In addition to direct separation of pathogens by the membrane, it would also be expected that pathogens could be captured in the floc structure of the MBR mixed liquor, and by filtration through the cake layer that typically occurs in an MBR system. In cases where membrane air scour and membrane maintenance procedures create sufficient shear force to break apart mixed liquor particles, the pathogen removal efficiency might be reduced owing to the smaller particle size and potential passage through the membrane pores.

MIT: the key difference between MBR membranes and potable water membranes

Both membrane integrity tests (MIT) and online turbidity monitoring are used in drinking water applications to ensure compliance with the log removal value (LRV) requirements tied to Giardia and Cryptosporidium removal, and to ensure the detection of any failed membranes. Trains found to have membrane integrity issues based on the prescribed MIT for potable water, typically a pressure decay methodology, are taken out of service until repairs are completed. This leads to significant membrane redundancy requirements and maintenance costs for potable water membrane treatment systems.

It is less practical to implement both pressure decay and turbidity monitoring for MBR systems. The pressure decay MIT method is very stringent, and, if employed for MBRs, would result in greater downtime, redundancy requirements and maintenance costs than if turbidity were the sole, and surrogate, MIT parameter to be monitored. In fact, this reflects how MBR systems are designed, allowing efficient MBR and pathogen reduction systems to be put in place, while ensuring public safety.

Turbidity and its correlation with disinfection performance by membranes

During the ‘Ask the Experts’ session at the WEF Membrane Applications 2010 conference, several membrane vendors noted that a relationship has been observed between MBR effluent turbidity and pathogens. Figure 1 illustrates data provided by one membrane vendor, which demonstrates a relationship between MBR effluent turbidity and fecal coliform counts. Although the correlation shown is not rigorous, due, for example, to the data being taken as grab samples rather than continuously online, one could conclude from this preliminary data that fecal coliform levels of 50 MPN per 100 mL could be achieved provided that the turbidity is less than 0.2 NTU. Additional data would be needed, however, if obtained, MBRs could be considered as providing a sufficient disinfection function in some jurisdictions provided the membranes were maintained to achieve a specified turbidity limit. When one considers that the routine turbidity standard for MBRs in North America is 0.2 NTU, then this approach is encouraging.

Conclusion

It is clear that a new thought process for the disinfection function of MBR systems is emerging, especially for areas where 100 or 200 MPN/100 mL is the target coliform level. It is timely to separate the anecdotal information from the facts, and to target research in this area. Dialogue between regulators, membrane manufacturers and engineers is encouraged to allow a concerted effort to develop the right parameters, allowing efficient MBR and pathogen reduction systems to be put in place, while ensuring public safety.

Most probable number (MPN): the MPN is a statistical estimate of the number of bacteria per unit volume and is determined from the number of positive results in a series of fermentation tubes.
Is the face of disinfection in Ontario changing?

Gary Hunter, Sean Partington, Richard Waite, Black & Veatch

Disinfection of treated effluents in Ontario has been a standard for many years. This practice of disinfection protects the receiving streams for uses by the public. As one looks to the future of disinfection in Ontario, several questions come to mind such as:

• Are there new microbial indicators that the Ministry of the Environment (MOE) will be examining?
• Are there additional emerging discharge contaminants that will impact the selection of the disinfection approach?
• What technologies will be used in the future?

These questions pose a number of challenges for utilities examining upgrades and modifications to existing disinfection facilities. While compliance with discharge requirements will be the main focus of the utility, pressures for attaining that requirement while being cost efficient are becoming more of a challenge.

New microbial indicators

The current microbial indicator established by the MOE is fecal coliforms. This indicator organism has historically been effective in demonstrating protection of public health. Recent studies conducted in other countries indicate that other microbial organisms such as enterococci may be a more effective indicator of effective disinfection. Over time, the MOE may consider adopting this organism as well. Additionally, future wastewater permit requirements may require the removal of viruses, Cryptosporidium and Giardia depending on the designated use of the water. Each type of disinfection technology will impact these organisms differently.

Another challenge that microbial indicators face is the time required for the analytical test. Typically, a fecal coliform test takes between 24 and 48 hours to obtain a result. This is especially critical where contamination may be occurring on beaches and impacting public health. In 2012, the United States Environmental Protection Agency (USEPA) will be recommending new bacterial guidance for water quality standards. As part of that guidance, it is anticipated that new methods such as qCPR will be recommended. Current USEPA research is examining how to correlate these results with traditional indicator organisms like fecal coliforms and enterococci.

Emerging discharge contaminants

Over the past several years, the issue of emerging contaminants in the effluent from wastewater treatment facilities has been a growing concern. Literature has indicated that disinfection technologies are one of the methods for removal of these contaminants from waste streams. Therefore, in the future, disinfection technologies may be required to not only remove bacteria, but also to achieve some level of removal of emerging contaminants.

Disinfection technologies

Existing disinfection technologies include bulk sodium hypochlorite and bulk sodium bisulfite, on-site generation of sodium hypochlorite and bulk sodium bisulfite, UV, chlorine dioxide, ozone, peracetic acid, ferrate and pasteurization. To fully assess these disinfection technologies, bench scale testing should be conducted to assure compliance with current and future requirements.

Disinfection studies conducted in the US have indicated that, while chlorine is still an effective disinfectant for enterococci, other disinfection technologies like UV may require additional modifications. Design of disinfection systems can become challenging, as there may be a number of end uses of the effluents, each with its own set of disinfection requirements. Since 1935, chlorination has been the most common method of wastewater disinfection. Despite its effectiveness, chlorine use has more recently been questioned for several reasons, e.g., transport of chlorine from the chemical manufacturer to the point of use carries quantifiable risks,
chlorine gas can be toxic, hypochlorite solution is corrosive, chlorine residual in treatment plant effluent can harm aquatic systems, and adding chlorine to wastewater can result in formation of undesirable disinfection byproducts (DBPs). Alternatives to disinfection with chlorine gas and hypochlorite have been developed to avoid some of these problems, however, chlorine use will not be completely discontinued in the near-term, because for many end uses a chlorine residual is still desired and/or required. Due to economic costs, a number of other disinfection technologies are being examined. These include the following:

- **UV disinfection**: has been used at many installations, but, to ensure disinfection, the water must be relatively free from substances that absorb UV light at 254 nm. One of the key limitations of disinfection with UV is that there is no form of residual disinfectant following treatment. UV is one of the more popular means of disinfection for secondary treated effluents.
- **Chlorine dioxide**: does not promote the formation of trihalomethanes (THMs) and is a highly effective bactericide and viricide. It has been used successfully for a number of years as a disinfectant alternative at drinking water production facilities. It minimizes the formation of disinfection by-products that may be discharged to the receiving stream. As well, research is being conducted on the use of chlorine dioxide at wastewater treatment facilities for minimizing the formation of DBPs. A review of literature indicates that, while chlorine dioxide is effective, it is several times more expensive than chlorine. Consequently, it has not found widespread use as a disinfectant at WWTPs.
- **Ozone**: has not been widely used for disinfection of WWTP effluents. Wastewater utilities recognized the benefits of adding ozone as a disinfectant to treated wastewater effluent. The literature indicates that the most significant factors that influence the ozone dose requirements are effluent chemical oxidation demand (soluble COD), influent bacteria density, and target effluent bacteria density.
- **Peracetic acid (PAA)**: is a promising new disinfectant that is being evaluated more frequently. There is debate among researchers whether its disinfection action occurs through active oxygen release or by the hydroxyl radical. In addition, no subsequent processes, i.e., dechlorination, are required. Literature indicates that paracetic acid has mostly been used for disinfecting discharges to marine waters which have less stringent discharge limits than reuse and recharge requirements. It has been shown that, under the right conditions (high PAA dosages, sufficient contact times, and adequate concentrations of organic and mineral constituents in the final effluent), the formation of the halogenated by-products may be a problem.
- **Ferrate treatment**: is an emerging disinfection technology for both drinking water and wastewater treatment that has been certified by NSF International. Its effectiveness has been studied for many years. Simply stated, ferrate is an iron atom with a plus-six charge, which is written as $\text{Fe}^{6+}$ or $\text{Fe}(\text{VI})$. Historically, producing stabilized ferrate meant numerous process steps and excessive synthesis, transport, and packaging costs (airtight containers). However, the newly-developed manufacturing process is safe and reliable, and reduces ferrate production costs by up to 90%. Recent studies with ferrate have indicated high level bacteria removal, with removal of phosphorus to 0.25 mg/L at the same time.
- **Pasteurization**: as a disinfection process is currently being researched. Results of this research indicate that this process can remove some viruses and, at certain treatment plants, can be cost effective. Sufficient testing has been completed to all the technology to achieve conditional acceptance for reuse applications in the US. Currently, the first pasteurization facility in the US is under design and construction.

**Conclusion**

The future will provide some very interesting challenges for disinfection approaches in Ontario. Discharge standards, testing methods, and technologies may all change over time and utilities will need to be looking at the most effective disinfection approaches, while remaining cost effective.
D
isinfection refers to the selective
destruction of disease-causing
organisms [4, pg. 324]. The most
common chemical disinfectants used in
municipal wastewater treatment plants
include gaseous chlorine and sodium
hypochlorite, both of which disinfect
through an oxidative process.

Final determination of the success
of the contact chamber disinfection is
determined by taking samples at the
end of the contact time and analyz-
ing for Escherichia Coli (E. coli), an
indicator organism used to indicate
the pathogen kill rate. With a 24-hour
incubation period and a typical mini-
mum of 48 hours to receive analytical
results, a real-time indicator of disin-
fec tion efficacy is required. Common
practice involves taking a grab sample
at the end of the contact chamber and
measuring the total chlorine residual
present. The presence of a certain total
chlorine residual is often thought of as
an indication that a particular E. coli
kill level has been achieved. However,
operator experience proves that this is
not the case.

When gaseous chlorine or sodium
hypochlorite is added to wastewater,
hypochlorous acid and hypochlorite
ions are formed, which are defined as
free available chlorine. In most waste-
water treatment plants, the present
ammonia-N reacts with the free chlo-
rine to produce three different inor-
ganic chloramines; monochloramine,
dichloramine, and nitrogen trichloride
(trichloramine). The amounts of each
compound depends on the pH of the
water, temperature, contact time, and
the chlorine-to-ammonia ratio, with the
total referred to as combined available
chlorine. The sum of the free avail-
able chlorine and combined available
Research by Danish virologist Dr.
Ebba Lund [2] first indicated a direct
link between the disinfection rate of
poliovirus and the oxidation reduction
potential (ORP). She found that a given
ORP held for a period of time would
produce a repeatable inactivation curve.
Lund’s work led to the development of
Lund’s Law of Oxidative Disinfection:

The log decrease in microorganism
activity is proportional to the ORP
maintained times the contact time.

Victorin et al [5] also studied the
kill of E. coli with many disinfectants
and found that ORP was found to be
better correlated with the disinfecting
property of the water than the available
chlorine. Figure 3 shows ORP curves
as a function of the concentration of
the various chlorine compounds. The
same amount of the various chlorine
compounds produces varying ORP
values, indicating disinfecting power.
Free chlorine has the highest disinfect-
ing power while chloramine-T has the
lowest disinfecting power. In other
words, ORP measurement provides
an indication of the effectiveness and
efficacy of the oxidizing agents.

ORP (also referred to as redox) is a
measurement of the electromotive force
(emf) generated when an oxidant is
present in an aqueous solution. Measur-

Table 1: Median lethal concentration (LC50) of chlorine compounds for mosquitofish exposed for 1 hour [3]

<table>
<thead>
<tr>
<th>Chlorine compound</th>
<th>Formula</th>
<th>LC50, mg/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dichloramine</td>
<td>HNCl₂</td>
<td>0.37</td>
</tr>
<tr>
<td>Hypochlorous Acid</td>
<td>HOCl</td>
<td>0.46</td>
</tr>
<tr>
<td>Monochloramine</td>
<td>NH₂Cl</td>
<td>1.31</td>
</tr>
<tr>
<td>Hypochlorite Ion</td>
<td>OCl⁻</td>
<td>2.21</td>
</tr>
<tr>
<td>Ethanolchloramine</td>
<td>HOCH₂CH₂NHCl</td>
<td>15.4</td>
</tr>
<tr>
<td>N-Chloroglycine</td>
<td>COOCH₂NHCl</td>
<td>575</td>
</tr>
</tbody>
</table>
able in millivolts (mV), the strength of this force is directly proportional to the oxidative strength of the treated system. In an oxidant environment, the ORP sensor measures the potential transfer of electrons from the sensing electrode to the oxidant causing an increase in the ORP voltage reading. When the ORP sensor is in the presence of reductants, they provide an easier source of electrons for the oxidant as compared to the sensing electrode and therefore the ORP reading decreases. The potential difference between the oxidation-reduction species and that of the reference electrode is what produces the measured voltage [6, pg. 807].

In a municipal wastewater treatment plant disinfection application, the chlorine compound(s) (the oxidant) steals electrons from the organic material and microorganisms (the reductant), which are then inactivated or killed.

Oxidation-reduction potential
measures the net potential from the aqueous system composed of oxidants and reductants giving ORP the unique ability to detect whether the chlorine compounds that are present are sufficient to meet the demand. The general oxidation-reduction reaction in the aqueous phase can be illustrated by:

\[(\text{Ox}) + m\text{H}^+ + ne^- \leftrightarrow (\text{Re}) + q\text{H}_2\text{O}\]

Where
- Ox = oxidant
- Re = reductant
- m, n, and q = reaction coefficients

If the Nernst equation is applied to the above reaction, we obtain:

\[E = E^o + \frac{RT\ln [\text{Ox}] - mRT\text{pH}}{nF} - \frac{nRT}{[\text{Re}]nF}\]

Where
- \(E\) = redox potential
- \(E^o\) = standard oxidation potential
- \(R\) = gas constant
- \(T\) = absolute temperature
- \(F\) = Faraday constant

As shown in this equation, ORP responses are logarithmic, making them most sensitive at extremely low levels of both chlorine and sulphite (see Figure 5). This makes detection and control of low levels of chlorine or sulphite using ORP practical and, therefore, applicable to the control of the dechlorination process.

As part of a chlorination and dechlorination control strategy, and according to Lund’s Law, maintaining a constant ORP value within the disinfection contact chamber is an accurate predictor of the microorganism kill rate. A properly configured control algorithm is able to ensure a constant ORP value within the contact chamber by automatically modulating the chemical feed rate to compensate for changing oxidant and reductant levels. However, in order to provide a successful control system, a number of often overlooked factors need to be considered.

**ORP sensor design**

One of the most important discoveries made was the necessity of having the sensing electrode made of 99.999% pure platinum to eliminate sensing errors. The ORP sensor design must also remain stable in the presence of potentially interfering ionic species, be able to operate in highly oxidizing environments without being ‘poisoned’ and be able to read small voltage changes in ORP.

**Control algorithm**

Municipal wastewater treatment plants are characterized by highly variable flow rates and long lag times. The control algorithm utilized for the control strategy attempting to maintain a constant ORP value within the effluent disinfection contact chamber must be suitable for these conditions. Lag time is described as the time it takes for the chemical to travel from the injection point to the ORP sensor, which varies with the process flow rate. The chlorination control application used when disinfecting with chloramines requires a long lag time, since the ORP sensor must be located a minimum distance downstream of the chlorine injection point to ensure that all of the free chlorine has had substantial time to combine with the present ammonia-N to form chloramines used for disinfection.

**Nitrification and ORP**

Most wastewater treatment plants disinfect with chloramines, which is a family of chlorine compounds formed when free chlorine reacts with ammonia-N. For plants that disinfect with free chlorine due to low or zero levels of ammonia-N within the
contact chamber, it can be anticipated that chlorine feed rates will increase as compared to disinfecting with chloramines. Although free chlorine is a stronger oxidant with a higher ORP value, it tends to oxidize other components within the wastewater before it oxidizes coliforms and E. coli. The ORP setpoint utilized for disinfection control is significantly higher when controlling a free chlorine disinfection process. There have been some studies indicating that a loss of ammonia-N leads to increased levels of organic nitrogen and increased levels of organochloramines, which has low germicidal properties [6, pg. 597]. Free chlorine hydrolyzes quickly to form organochloramines.

It is important to ensure the control algorithm is able to compensate for facilities that periodically nitrify, a phenomenon that is more common than is widely understood. When a facility nitrifies, the chlorine to ammonia-N ratio exceeds 6:1 and free chlorine is seen in the contact chamber. This is known as breakpoint chlorination. Once free chlorine is present, the ORP value rises well above the established ORP setpoint and will cause a decrease in the chlorine feed rate to compensate. This is an improper response since, as described, a higher chlorine dosage is required when disinfecting with free chlorine. The control algorithm should include a secondary control input with a different ORP setpoint to accommodate such temporary conditions.

**Mixing**

Effective mixing of the chemical solution with the process wastewater is considered as a critical component of the disinfection process. There has been some indication that, without proper mixing, a larger percentage of the chloramine compounds consists of organochloramines, an ineffective disinfectant [6, pg. 626]. With proper mixing, reaction between free chlorine and ammonia-N tends to produce considerably more monochloramine, a more effective disinfectant, which leads to better kill rates at the same chemical feed rate.

**Setpoint determination**

Although experience utilizing ORP as part of a chlorination and dechlorination control strategy is critical, it is important to understand that all treatment plants behave differently when it comes to disinfection. When commissioning the ORP based control system, operation staff must be trained on how to establish ORP setpoints. Operators need to determine, through a rigorous sampling program, what ORP value within the contact chamber correlates to a level of E. coli kill for chlorination and to less than 0.02 mg/L of chlorine residual for dechlorination applications.

**Practical experience in Ontario**

Several ORP-based control systems for the automatic control of the chlorination and dechlorination process in municipal wastewater treatment plants have been successfully commissioned in the Province of Ontario. Many of these installations have been operational for years with great success. One of the benefits of ORP technology is its ability to operate without fouling, with only minimal maintenance. ORP sensors designed specifically for dirty water applications are available and well suited to wastewater. Furthermore, facilities have determined that a properly designed control strategy utilizing ORP as the basis is able to effectively, consistently, and automatically meet E. coli (chlorination) and chlorine residual (dechlorination) discharge limits stipulated in the Certificate of Approval. Since the ORP control strategy is demand based, only feeding the amount of chemical required at any given time, significant chemical savings is often an added bonus.

**References**


Max Rao is the Canadian Sales Manager for Indachem Inc., the exclusive national distributors for Siemens Water Technologies Strantrol ORP based controllers.
UPDATING THE ‘FACE’ OF WEAO

Jeremy Kraemer, CH2M HILL, and Alvin Pilobello, AECOM

In 2009, WEAO embarked on an important project to update the association’s website. As the ‘face’ of the Association, the website is an important tool to communicate with our members and the public. However, the website had become dated and a functionality brainstorming session by the Website Sub-Committee determined there were many more functions that should be pursued to improve the membership experience and facilitate committee activities.

Initially, the project focused on the visual aesthetics of the website. However, it was quickly realized that, to achieve the improved functionality established by the brainstorming session, the project focus needed to shift from the front-end visual aesthetics to the back-end, i.e., the database. Sophisticated websites that allow users to log-in and present different content based on the user’s profile require a database. In addition, most sophisticated websites have the visual aesthetics separated from the content: the aesthetics are determined by ‘templates’ or ‘skins’ which can be readily updated completely independent of the content (words, pictures, videos and documents).

The Sub-Committee discovered a specialized software system ideally suited to WEAO: an Association Management System (AMS). An AMS is a computerized system which provides a non-profit organization with database features to run its operations, such as member services, dues notice and collection, event management, committee management, and member communication. Typically, an AMS is also linked to the association’s website, allowing members to log-in and make discounted purchases, register for events, update contact information, and share documents through committees with which the member associates.

An important aspect of the transition to an AMS is the need to ensure integration with the membership system of the Water Environment Federation (WEF), because more than half of all WEAO members are WEF members. WEF is currently undergoing a significant revamp of its own membership database system, so the requirements of integrating with its system are still being determined.

Through a Request for Information (RFI) process, the Website Sub-Committee evaluated four established AMS vendors in three ways: (i) how their systems could meet the needs of the Association, as noted in their proposals, (ii) the look, feel, and demonstrated functionality of their AMS through live webinars, and (iii) cost.

The preferred vendor recommended by the Sub-Committee to the WEAO Board of Directors is MemberClicks of Atlanta, Georgia (http://www.memberclicks.com/). The MemberClicks system is completely web-based and can achieve almost all of the desired functionality. It is a good fit for WEAO because their fees are based on users, not ‘admins,’ which provides tremendous flexibility to allow distribution of work like managing members, association activities, and website content among our many volunteers. Also, fees are monthly (not a long-term contract), which has two benefits: WEAO is not locked in and could change providers relatively quickly if necessary, and this fee structure promotes the vendor to continually ensure we are a satisfied customer. MemberClicks has a strong focus on smaller organizations like ours that have few if any paid staff; their typical client is 2,000 - 3,000 members. In terms of security, their data centre is housed in the same location as Home Depot, with retina scanners for entry. WEAO would own all data and website content and we can make backups for our own data security, if desired.

Currently, the Sub-Committee is working to secure a contract with MemberClicks and begin the implementation process. The new website launch is aimed for WEAO’s 40th anniversary, at the Annual Conference & OPCEA Exhibition, April 10-12, 2011, in Toronto.

A new and improved website will not only improve the operation of WEAO’s staff and committees, but will also demonstrate WEAO’s significance among water environment industry professionals and the public.

Acknowledgements

The Communications Committee is responsible for the publication of INFLUENTS magazine and the content of the WEAO website (www.weao.org). If you are interested in joining the committee, contact the Chair Pat Coleman (pat.f.coleman@aecom.com). The hard work of the Website Sub-Committee members is sincerely appreciated: Anne Baliva, Emil Cocirlea, Pat Coleman, Louise Hollingsworth, Greg Jackson, Jeremy Kraemer, Alvin Pilobello, and Julie Vincent.

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The AWS installation at Timberland Landfill near Brewton, AL is a recent recipient of an award for ‘Engineering Excellence’ from the American Council of Engineering Companies.

In Ontario the AWS has been approved for use by the Ontario Ministry of Environment through over 40 Certificates of Approval for treatment of sanitary sewage, landfill leachate and various types of agricultural wastewater.

For more information please contact Lloyd Rozema at:
cell: 905-327-4571
office: 905-563-3778
email: lrozema@aqua-tt.com
WEAO INFLUENTS: 2010 SURVEY RESULTS

Alvin Pilobello, AECOM, on behalf of the WEAO Communications Committee

EAO INFLUENTS magazine is currently in its fifth year and is published four times a year under the direction of the Communications Committee. It has evolved to having a theme for each spring (March), summer (June), fall (September) and winter (December) issue.

The committee solicits and selects articles for inclusion in the magazine to reflect the interests of the association membership and works with the magazine editor and publisher (Craig Kelman and Associates Limited) in finalizing the content and look of INFLUENTS. The publisher assumes responsibility for selling advertising for each issue with a contractual profit-sharing with WEAO.

The Communications Committee coordinates the INFLUENTS survey at every WEAO conference in order to (a) increase the profile of INFLUENTS, (b) provide valuable feedback regarding our areas of interest, (c) promote the advantages for a company to advertise in INFLUENTS, (d) collect feedback from readers regarding the magazine issues already published, (e) gauge their anticipation for future issues, and (f) determine the INFLUENTS themes they are most interested in for upcoming issues.

At the 2010 WEAO conference in London, Ontario, six student volunteers were recruited to conduct a one-page survey to accomplish the above objectives. Over 90 attendees were surveyed over the three-day conference. They included consultants, government employees, operators, suppliers, technicians, students and other occupations within the water/wastewater industry.

Final results
Among the 2009 themes, the ‘Beneficial Use of Biosolids’ (winter 2009) and ‘Small Systems in Rural Ontario’ (summer 2009) issues were the most popular.

The most anticipated 2010 themes are ‘Chemical Use in Wastewater Treatment’ and ‘Pumps and Pump Station Design.’

Eleven new themes were provided on the 2010 survey, with an opportunity to suggest other topics. Of those listed, the four themes that received the most votes are: (i) Methods of Project Procurement and Delivery, (ii) Control of Odours, (iii) Methane and Green Energy, and (iv) Cities of the Future.

Acknowledgements
The WEAO Communications Committee would like to thank the six enthusiastic student volunteers who conducted the 2010 INFLUENTS survey: Angel Nakevski (UWO), Leila Tootchi (Windsor), Reuben Fernandes (Ryerson), Mina Mirzajani (Ryerson), Kirill Cheiko (Ryerson) and Sarah Shim (Ryerson). Thanks also to Julie Vincent and Anne Baliva for their support from behind the registration desk.

BUC/WEAO WORKSHOP ON ALTERNATIVE MANAGEMENT OPTIONS FOR SEWAGE BIOSOLIDS

Amanda Wouters B.A., M.P.A., Ministry of the Environment

On Thursday June 17, 2010, the Water Environment Association of Ontario (WEAO) and the Biosolids Utilization Committee (BUC), in conjunction with the Rural Ontario Municipal Association (ROMA) and the Ontario Ministry of the Environment (MOE), successfully hosted the Alternative Management Options for Municipal Sewage Biosolids Workshop at the Canadian Centre for Inland Waters (CCIW) in Burlington, Ontario.

Attendees heard from the workshop’s nine speakers on a variety of topics including energy recovery, composting, non-agricultural land uses and nursery tree fertilization. From all reports, it was a well executed and informative workshop. On July 6, 2010, a thorough article on the workshop appeared in the Ontario Farmer.

In total, 101 people attended the workshop, of which 86 were delegates and six were exhibitors. Making up the balance were speakers, a media representative and staff members. Of the workshop’s delegates, 33% were from a municipality, with an additional 16% from companies that operate municipal treatment plants (e.g., OCWA, Veolia, etc.). Thus, the workshop met its goal to provide information on sustainable alternative options for managing sewage biosolids to municipal decision-makers. Also in attendance were representatives from industry, the Ontario Federation of Agriculture, Environment Canada, the Rural Ontario Municipal Association, and Citizens for a Safe Environment, among others.

All nine presentations are now posted on the WEAO website at: http://www.weao.org/committees/biosolids/biosolids.html.

Click HERE to return to Table of contents
June 1, 2010 was a fine early summer day as members of the Select Society of Sanitary Sludge Shovelers (SS) gathered at St. George’s Golf and Country Club for the SS annual luncheon. Forty people assembled to enjoy the pleasant surroundings of the club, to renew acquaintances with other SS members, and to officially induct new Shovelers for 2010.

This year, the inductees were: Janice Janiec, George Lai, Ken McKinnon, and Gord Miller.

Janice Janiec, Project Manager Biosolids/Agronomy with the City of Guelph, has been very active in WEAO for many years, particularly with the Conference Committee. She was the chair of the Annual Conference in 2008. She also served as a WEAO director from 2002 to 2005.

George Lai, Water Approvals Engineer with the Ministry of the Environment, has also been extremely active in WEAO, serving on committees and later on the WEAO Board. He served as WEAO president in 2008-2009.

Ken McKinnon, formerly an Operations Supervisor with the City of Toronto and now retired, has been active at the Annual Conference since 1998, helping to raise funds for the Hospital for Sick Children.

Gord Miller, Environmental Commissioner of Ontario, was the keynote speaker at the 2008 Annual Conference and has supported the work of WEAO and its members for many years. He was a scientist, manager of training and development, and a district manager during a 14-year career with the Ministry of the Environment.

Although Janice and Gord were not able to attend, George and Ken were ‘officially’ inducted and congratulations were extended to all the inductees. Jim Brooker handled the induction ceremony with all due pomp and solemnity in the absence of Peter Laughton, the honourable pH 7, who was not able to attend due to illness. Best wishes for a speedy recovery were offered to Peter by all.

In addition to the induction of the new members, the assembly recognized Tom Davey, upon whom was bestowed the Geoffrey T. G. Scott Memorial Award, in recognition of his many years of devotion to writing on environmental matters and his steadfast support of the profession of environmental engineering.

Following a sumptuous luncheon, the attendees were treated to a presentation by Carole Seysmith, Lake Simcoe Stewardship Program Specialist with the Ministry of Natural Resources. Carole provided a lucid review of the Lake Simcoe Protection Plan, including the Phosphorus Reduction Strategy, the Shoreline Regulation, and the Stewardship Education and Incentive Program.

She also described two key stewardship programs – the Environmental Farm Program and the Lake Simcoe Community Stewardship Program – as well as the Lake Simcoe Stewardship Network.

Carole spoke very knowledgeably and enthusiastically and was able to answer the many questions that were posed. She encouraged everyone to consider becoming involved in the developing Lake Simcoe Stewardship Network.

We would like to extend our thanks to Patricia Mann and the staff of St. George’s for making the luncheon a memorable event once again. This time, we had to share the spotlight with golfer Mike Weir, who was attending a press conference leading up to the Canadian Open. Notwithstanding the prestige and the level of activity associated with the press conference, the club staff attended to our needs with their usual efficiency and care. We also acknowledge with thanks Elgin Horton, a member of the club, who acted as our sponsor once again.

Peter Takaoka, Ken McKinnon, George Lai
Photo courtesy of Environmental Science and Engineering Magazine

Ken McKinnon, George Lai, Jim Brooker. Photo courtesy of Environmental Science and Engineering Magazine

Guest Speaker: Carole Seysmith
Lake Simcoe Stewardship Program Specialist, Ministry of Natural Resources. Photo courtesy of Environmental Science and Engineering Magazine
I N T E R N A L  A F F A I R S

THE NEW COLUMN NAME IS ‘IN THE LOO’

Louise Hollingsworth

Got any dirt? Gossip – rumour – innuendo? Good news – sad news? Let me help you tell the world. I think it is important to share what is happening, like who moved to what company? Did anyone get married or did we lose anybody?

This past July, after riding my motorcycle to Chicago and ACE, thereby becoming a Water Buffalo, I myself moved from Water For People – Canada. Next, I write my water and wastewater operators exam in September. I plan to explain the process I went through in an upcoming issue.

Most of us already knew that Don Kemp, who shares a common history with RVA with myself, is now project manager of AECOM, and is now our leader at the WEAO. In addition, I was saddened to see Bob Kuzyk, a lovely man here in London and also with RVA, lose his dear wife Maureen this past winter.

I look forward to meeting Jeremy Kraemer’s (recently promoted to the level of senior technologist and assigned the role of ‘Canadian Region Wastewater Technology Leader’ at CH2M HILL), and his wife Amanda King’s new baby (who just might be named Louise), due about the time of this issue.

Let us not forget the nuptials of Carrie Vincent, Assistant Administrator for WEAO from June 2003 to June 2009. Carrie and her new husband, Roger Humphrey, were actually married in a civil ceremony on March 17, 2010 at the Banff Springs Hotel, with the Mayor of Banff conducting the ceremony. However, on Saturday, September 4, there will be a full do-over, with 100 family members and friends, and Cordell Samuel, Past President and WEF Delegate for WEAO, presiding as the Minister. A true WEAO romance/news story.

So email your tidbits to me, Louise Hollingsworth at louhollingsworth@yahoo.com, and we will share them here in my new column ‘In The Loo.’
ENERGY OPTIMIZATION AND SUSTAINABLE DESIGN SEMINAR: A WEAO SPECIALTY SEMINAR

Andrew Smale, AECOM, Wastewater Treatment and Technology Committee

On November 3, 2010, the Energy Optimization and Sustainable Design Seminar will take place at the Milton Best Western. This will be a one-day specialty technical seminar brought to you by the Wastewater Treatment and Technology Committee, which will consider topics about energy management and environmental sustainability as they relate to the design and operation of wastewater treatment facilities.

Topics will include a review of global trends toward targeting energy neutral facilities, carbon footprinting and greenhouse gas accounting, present and future legislative framework, and energy recovery opportunities.

The registration form and session program is available at the WEAO website at www.weao.org. Early registration is $250 for WEAO members, $150 for New Professionals, and $350 for non-members. Early registration ends October 15, 2010.

The Wastewater Treatment and Technology Committee would like to extend our thanks to ACG Technology Ltd. for its sponsorship of the morning coffee break, Conestoga Rovers & Associates and H2Flow Equipment and for their sponsorship of the lunch, and of the proceedings for this seminar.

For inquiries about seminar content, please contact Andrew Smale at (905) 747-7606 or andrew.smale@aecom.com. For all registration inquiries, please contact Julie Vincent, WEAO Administrator.

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Influents  Fall 2010  45
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VWS Canada, the Canadian subsidiary of VWS, has proudly served Canadian municipalities for more than 60 years. We design, manufacture, and support drinking water, wastewater, and biosolids solutions locally for communities across Canada.
### SEPTEMBER

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<tr>
<th>Date</th>
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<tr>
<td>Sept. 10</td>
<td>Committee Chairs Group WFPC Committee 09:30 am Conference Call 10:00 am</td>
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<tr>
<td>Sept. 12-15</td>
<td>25th Annual WateReuse Symposium, Washington, DC</td>
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<td>Sept. 14-15</td>
<td>PWO Northeast Region Training Day &amp; Conference Holiday Inn Sudbury 8:00 am</td>
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<td>Sept. 16</td>
<td>12th Annual WEAO Golf Tournament Scholarship Fundraiser Shawnneki Golf Club Newmarket, 11:00 am</td>
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<tr>
<td>Sept. 17</td>
<td>EHS&amp;S Committee WEAO Office, Milton 10:00 am</td>
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<tr>
<td>Sept. 17</td>
<td>INFLUENTS Release Date</td>
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<tr>
<td>Sept. 18</td>
<td>WORLD WATER MONITORING DAY</td>
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<tr>
<td>Sept. 21</td>
<td>Board Meeting AECOM Offices 5600A Cancross Court Mississauga, 9:30 am</td>
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<td>Sept. 29</td>
<td>PWO Southwest Region Conference, Chatham</td>
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### OCTOBER

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<tr>
<td>Oct. 2</td>
<td>Great Canadian IceBreaker The Court of Two Sisters 613 Royal Street, NO 7:00 pm - 10:00 pm</td>
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<td>Oct. 2-6</td>
<td>WEFTEC®10 Ernest N. Morial Convention Center New Orleans, Louisiana</td>
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<td>Oct. 4</td>
<td>Canadian Affairs Council Meeting Ernest N. Morial Convention Center New Orleans, Louisiana 1:30 pm</td>
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<td>Oct. 8</td>
<td>WFPC Committee Conference Call, 10:00 am</td>
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<td>Oct. 13</td>
<td>Government Affairs Committee Hatch Mott MacDonald Mississauga, 9:30 am</td>
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<tr>
<td>Oct. 19</td>
<td>Board Meeting AECOM Offices 5600A Cancross Court Mississauga, 9:30 am</td>
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<tr>
<td>Oct. 21</td>
<td>Communications Committee WEAO Office, Milton 10:00 am</td>
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<tr>
<td>Oct. 25 &amp; 26</td>
<td>PWO Southeast Region Workshop &amp; Conference, The Legion Kingston</td>
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<tr>
<td>Oct. 30- Nov. 2</td>
<td>14th Canadian National Conference &amp; 5th Policy Forum on Drinking Water Sheraton Cavalier Hotel Saskatoon, SK</td>
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### NOVEMBER

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<tr>
<td>Nov. 3</td>
<td>Energy Optimization and Sustainable Design Seminar Best Western, Chisholm Drive, Milton 8:30 am</td>
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<tr>
<td>Nov. 5</td>
<td>Submission Deadline for INFLUENTS</td>
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<tr>
<td>Nov. 12</td>
<td>WFPC Committee Conference Call, 10:00 am</td>
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<td>Nov. 16</td>
<td>Board Meeting, AECOM Offices 5600A Cancross Court Mississauga, 9:30 am</td>
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<tr>
<td>Nov. Science Teachers’ Association of Ontario STA02010, DoubleTree International Plaza Hotel, Dixon Road, Toronto</td>
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<td>Nov. 17-19</td>
<td>A.D. Latornell Conservation Symposium, Alliston, ON</td>
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<tr>
<td>Nov. 18</td>
<td>Asset Management Committee Seminar Teatro Conference Centre, Chisholm Drive, Milton 8:00 am</td>
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### DECEMBER

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<tr>
<td>Dec. 1</td>
<td>EHS&amp;S Committee Security Seminar AJ Tyler Operations Centre 663 Bathurst Street, London, Ontario</td>
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<td>Dec. 10</td>
<td>Committee Chairs Group TBA, 9:30 am</td>
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<td>Dec. 14</td>
<td>Board Meeting TBA</td>
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<td>Dec. 15</td>
<td>Government Affairs Committee TBA, 9:30 am</td>
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### JANUARY 2011

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<tr>
<td>Jan. 18</td>
<td>Board Meeting AECOM Offices Mississauga, 9:30 am</td>
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### FEBRUARY 2011

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<tr>
<td>Feb. 15</td>
<td>Board Meeting AECOM Offices Mississauga, 9:30 am</td>
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### MARCH 2011

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<td>Mar. 8</td>
<td>Board Meeting AECOM Offices Mississauga, 9:30 am</td>
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<tr>
<td>Mar. 17-18</td>
<td>WEFMAX 2011 Atlantic City, NJ</td>
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### APRIL 2011

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<tr>
<td>Apr. 10-12</td>
<td>40th ANNUAL TECHNICAL SYMPOSIUM &amp; EXHIBITION The Westin Harbour Castle Hotel, Toronto</td>
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Check for updates on our web site [www.weao.org](http://www.weao.org)
GREG JACKSON BELIEVES IN GETTING INVOLVED

When Greg Jackson attended his first WPCF conference in 1981, he was amazed at the size of the trade-show. “I walked around that hall and said to myself ‘we have to get closer to this industry’,” he recalls.

At the time, he was working as a Canadian sales representative for SEW Eurodrive, an international manufacturer of electro-mechanical drives. Quickly becoming the company’s go-to guy for the water and wastewater industry, he advanced to regional manager.

It helps that Jackson has a natural talent for understanding this kind of technology. “I have seen many kinds of manufacturing and industrial processes,” he adds. “But, the environmental and water side was always the most interesting to me.”

In 1981, SEW Eurodrive joined OPCEA, with Jackson as the company’s representative, eventually serving as president in 1988-89. As his interest in water and wastewater continued to grow, he left SEW for Control and Metering, further perfecting his knowledge base.

But, when the company restructured in 1994, eventually divesting itself of its water and wastewater involvement, Jackson was ready to move on. Returning to his earlier roots, he accepted a position as president, running the North American operations of Bonfiglioli, an international manufacturer of transmission equipment.

Nonetheless, water and wastewater continued to be an important area of interest for Jackson. A long-time member of WEAO, he became increasingly involved in the conference committee and eventually joined the Board from 1997-99.

Then, after a brief stint working in the pharmaceutical industry, he returned to water and wastewater in 2002 with C&M Environmental. Subsequently, in 2004, he acquired ACG Technology Ltd., along with business partners Roy Budd and Blake Tonogai. “When we took over ACG, it was primarily manufacturing industrial wastewater systems,” recalls Jackson. “The first thing we did was to diversify into municipal, and then drinking water and stormwater.”

Today, ACG has become a national distributor of stormwater treatment systems, with Jackson conducting frequent lunch and learn sessions on the subject. “I would like to see WEAO reach out to stormwater engineers,” he adds. “Stormwater management and treatment is a key facet of source water protection.”

It is something he would like to promote in his role as a member WEAO’s Communication Committee. Lately, however, he has been preoccupied with working on the association’s website, an experience which has proven invaluable to his role in OPCEA as well.

As the new president for 2010-2011, Jackson plans to upgrade both the website and OPCEA’s ability to communicate with members. He hopes to improve the site’s customer service and e-commerce capabilities, while addressing the challenges of collecting dues and keeping membership listings current.

If that seems a tall order, consider Jackson’s other volunteer commitment as vice-chair of Wounded Warriors.ca, a registered Canadian charity, dedicated to improving the lives of Canadian soldiers injured in service. Between his work, volunteer and family commitments, Greg Jackson is a busy man indeed.

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The 19th Annual OPCEA Golf Tournament was held on June 2, 2010 at its new location, Cardinal Golf Club. This year’s tournament had 292 registered golfers and 32 company-sponsored holes. While the weather was uncooperative, with thunderstorms and heavy rains throughout the afternoon, the steak dinner that followed was delicious. Congratulations to Greatario Team #1 of Scott Burn, Neil Awde, Perry Rose and Jeff Roger, who won the tournament with a score of six under par. A putting contest and 50/50 draw were also held, raising $1,600 for Water For People. Special thanks to Ross Humphry, Heinz Held and Mark Reeves, who worked at the registration desk and organized the prizes, and to Brian Allen for organizing another successful tournament.

Company-sponsored hole winners:
- Ian Barrett
- Steve Davey
- Donny DiZio
- Brian Cooper
- Al Farrell
- Lloyd Clarke
- Darryl Annis
- James Witherspoon
- Penny Davey
- Andrew Farr
- Jim Nardi
- Roland Barbazza
- Len MacDonald
- Rhonda Harris
- Scott Thompson

Bob Fields
Dave Graham
Iggy Ip
Nikin Panchal
Steve Gregory
Perry Rose
Matt McBride
Deepak Argl
Martin Thissen
Michael Nissenthall
Greg Vissers
John Helka
Kevin Guigley
Scott Taylor

There were three holes where no prize winner was declared. These prizes were raffled off.

Thank you to the following companies for sponsoring holes:
- SEW-Eurodrive Company of Canada
- Cancoppas Limited
- ITT Water & Wastewater
- ENV Treatment Systems
- GEA Westfalia Separator Canada Inc.
- ACG Technology Ltd.
- Metcon Sales & Engineering Limited
- Pro Aqua, Inc.
- EIMCO Water Technologies
- SNF Canada Ltd.
- Environmental Science & Engineering magazine
- Envirocan Wastewater Treatment
- C & M Environmental Technologies Inc.
- Summa Engineering Limited
- BASF Canada Inc.
- Siemens Water Technologies Canada Inc.
- SPD Sales Limited
- Indachem Inc.
- Directrik Inc.

Hole in One Canada winners:
- West #16 – Closest to the pin – Ed Vezsenyi
- East #2 – Closest to the pin – Mark Seymour ♦
GUY ‘JIMMY’ RED: METICULOUS MAN OF MANY TALENTS

It says a lot about Guy ‘Jimmy’ Red that he has already been cited for several health and safety awards since starting as an operator-in-training at the Clarkson Wastewater Treatment Plant a mere two years ago. And these accolades are not the only indicators highlighting the meticulous nature of this newly-minted Level I operator.

One day, as he was checking the level of natural gas consumption at the plant, he noticed a large discrepancy between the reading and the usual usage. To verify his assessment, Red went back to the meter, then again to the boilers. When he returned a final time to the meter, he noticed bubbles at the top. There was a leak. Red promptly reported the problem to the foreman and the leak was addressed immediately.

If this kind of attention to detail makes the 53-year-old well suited for his new career as an operator-mechanic, so does his extensive and varied background experience. Before immigrating to Canada in April 2003, Red worked for 20 years as a marine biologist and policy developer with the Philippine Department of Fisheries.

After arriving in Toronto, Red found a job as a cleaner with one of the private contractors for the Ontario Clean Water Agency (OCWA). As someone who enjoys working with people, the new immigrant quickly made many friends.

“They told me ‘you can qualify to be an operator-mechanic by getting your operator training licence,’” he recalls. Taking them up on their suggestion, Red took his operator-in-training exam and passed easily. But, despite submitting his papers as soon as he received them, it would be a while before he was able to start working in the industry.

In the meantime, he worked in airport security and later as a baggage handler for Air Canada. Two years passed before Red finally received a call from the Clarkson Water Treatment Plant. “The call came on my cellular,” he recalls. “They asked me if I was still interested in a position. I said of course. Then they asked me when I could come for an interview. I told them, now, I am ready.”

During the interview, Red was asked if he had any mechanical and electrical background. It turns out he had. While in the Philippines, he learned how to overhaul a car engine and read a schematic diagram of an electrical system. (As Red puts it, he likes to keep busy.) The conversation then veered into water pumps, after which the multi-talented professional was offered a position as operator-mechanic at the Clarkson WWTP.

From the beginning, Red appreciated the hands-on approach of the training process. “Once you have the level one licencing, then you have the freedom to adjust the pumps under the supervision of the foreman,” he notes.

A year after starting at the Clarkson WWTP, Red passed his Level I operator’s licence. Since then, he has continued to put both his passion for details and his scientific background to good use. Because his work involves using the laboratory, Red has the opportunity to maximize on his former training. He enjoys studying the “bugs,” i.e., the microbes that are an important part of the treatment process.

At the same time, he finds the whole notion of working to meet the compliance standards very appealing. His workday usually starts with taking readings and making adjustments, then conducting lab tests to take further measurements. Based on the results, he conducts further adjustments on the pumps, water wasting systems and bio-solid digesters.

The Clarkson WWTP processes 150,000-200,000 cubic metres of influents a day. Yet, the sludge cakes produced are minimal, averaging a daily 40,000-80,000 kg.

Red is proud of contributing to the efficient working of the plant. For him, the challenge is always to go beyond simply meeting the standards. Instead, his goal is to exceed the requirements set by law. “It is good for the environment and it is good for our children,” he says.

After all, the Red family moved to Canada to ensure a better future for their own child. Their son is now in university working towards a law degree.

As for Red, he is currently working towards his Operator II licence and plans to continue his professional development as far as he can go. “This job has a career path,” he notes. “I am well-satisfied with the career I have now.”

He would love to work his way into management one day, but doubts that, at his age, he will have the time to reach this position. Yet, if his life so far is any indication, it will be no surprise if he manages to reach this goal one day.
This year’s 23rd WEF Operations Challenge event will take place at the New Orleans Morial Convention Center, New Orleans, Louisiana. With the event just around the corner, the opposing teams will find some strong competition this year. Joining teams from across North America will be two teams from Ontario – the Durham Sludgehammers and the Toronto Craptors.

The two Ontario teams earned the right to compete by placing first and second at the WEAO Operations Challenge competition held in London, Ontario this past April.

Each team will compete in five events consisting of: collection, laboratory, process control maintenance and safety. The winners are determined by a weighted point system for the five events that test the diverse skills required for the operation and maintenance of wastewater treatment facilities, their collection systems and laboratories.

Although familiarity with competing in these events will definitely be an asset, this year’s WEF will be introducing two events that have changed. The first event, the maintenance event, will test the knowledge and skill of the team to respond to separate and simultaneous ‘moisture reset’ failure conditions using a Wilo submersible pump and a Wilo submersible mixer. The second event to change this year is the lab event. The teams will have to perform all steps of an E.Coli membrane filtration analysis using Hach products as outlined in the Hach m-ColiBlue24 method and Standard Methods 922B, 18th Ed.

If you find yourself at the conference October 4-5, please stop by to cheer on our Canadian teams. Congratulations and best of luck to the Durham Sludgehammers and Toronto Craptors.

Next year’s WEAO Operations Challenge competition will be held at the 40th annual WEAO Technical Symposium & OPCEA Exhibition, April 10-12, 2011 at The Westin Harbour Castle, Toronto. For information about the Operations Challenge, please contact Norma Linkiewicz at norma.linkiewicz@niagararegion.ca.

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The Ministry of the Environment’s Water and Wastewater Operator Certification Program is going green. On-line Operator-in-Training (OIT) exams will soon be available at employer sites. Not only will on-line exams help reduce the carbon footprint; it will also improve the exam administration process.

The Ontario Water Wastewater Certification Office (OWWCO) administers the certification and licensing program for water and wastewater operators in Ontario on behalf of the Ministry of the Environment (MOE). All operators must successfully complete an exam before applying for a certificate or licence. Municipalities and other operating authorities are allowed to coordinate OIT exams at their locations. Currently, these examinations are administered in traditional classroom style venues using the pencil and paper method, requiring exams to be mailed back and forth from municipalities.

The target date for piloting the on-line exams at employers’ sites is November, 2010. Written OIT exams will be replaced with on-line examinations, offered through the internet.

Some key advantages that on-line exams will have over traditional pencil and paper methods are:

- Examinees will know immediately after completing the test if they passed or failed (currently, test results are provided between one and three weeks later);
- Hundreds of tests will no longer need to be printed;
- On-line testing allows for greater exam security;
- It is less likely for examinee error to occur when choosing answers (as opposed to filling in ‘bubble sheets’); and
- American states which have initiated computerized exams report much higher operator satisfaction with the exam process.

The successful implementation of on-line OIT exams will enhance the Water and Wastewater Operator Certification Program. In addition, it will potentially lead to the expansion of on-line exams for other certification categories – approximately 2,500 annually – and maximize efficiencies at a much broader level.

For more information on operator certification and licensing, please visit www.owwco.ca.
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am sure that most people have heard of ultraviolet light (UV) disinfection and have probably had some contact with the equipment directly, either at their home, work, cottage, or the home of friends or relatives. The explanation is usually that this technology disinfects water, but how? Well, the process is relatively simple and can be explained by drawing a comparison to real life. On a hot, sunny, summer day, the sun can beat down providing us with much needed vitamin D, but, at the same time, we are all aware of the UV light exposure. To prevent our skin from getting burned, we apply sunscreen. The reason our skin burns is that UV light is directly affecting our skin cells, but what is this UV light doing? Essentially, it is altering the genetic structure of our skin cells, preventing them from replicating themselves, which can lead to those cells ‘dying.’ As we all know, there are varying degrees of sun exposure, anything from a slight tan to a severe burn. The after effects of the severe burn are usually skin blistering and, eventually, flaking off, because the skin cells affected have received so much UV light exposure or DOSE that their genetic structure has been altered to a point of no longer being able to replicate. There is a simple formula that is typically used in UV water disinfection to determine the DOSE of UV light delivered. This formula is as follows:

\[ \text{UV DOSE} = \text{INTENSITY} \times \text{RETENTION TIME} \]

In effect of our example of a hot, sunny day, INTENSITY would be the UV rating that day, i.e., how much UV light penetrates through our atmosphere and is delivered to the Earth’s surface at your location. Therefore, independent of how long you are exposed to UV light, the more intense the UV light, the easier it will be to burn. In this example, RETENTION TIME refers to the amount of time you are in contact with exposure to UV light. Therefore, independent of the INTENSITY of UV on any given day, the longer you are exposed, the higher the risk. The combination of these two factors gives us our UV DOSE, which determines if we tan or burn.

The same principle as described here for humans is applied for bacteria and microorganisms in our drinking and waste water treatment systems, only this time, we are intentionally looking to achieve a UV DOSE high enough to ensure that all bacteria and microorganisms present are genetically altered sufficiently to prevent cell replication resulting in cell death and, effectively, disinfection of the water source.

Quite a bit of research has been done to determine what level of UV DOSE is required to effectively disinfect any given water source. This research is used by experts from UV technology suppliers to determine what UV DOSE will be applied to each individual water or wastewater system to disinfect the water, based upon site specific parameters.

**UV maintenance**

On a regular basis, like almost every other electro-mechanical piece of equipment, maintenance is required on UV equipment. The type of maintenance required ties into the explanation just given on how UV light works. It is not only specific to the mid to large size UV disinfection units that I typically work on, it will also apply to residential and industrial applications of almost every UV disinfection product. To explain maintenance, it is important to first understand how UV light equipment
operates. Typically, UV equipment consists of UV lights housed inside of a quartz sleeve (to protect the light’s electrical connections from direct contact with water). There are numerous arrangements to achieve this, but Fig. 2 and Fig. 3 illustrate a few common arrangements used.

The UV light created by the lamp is transmitted through the quartz sleeve (quartz allows virtually 100% of UV light to pass through it) and into the water to be treated. In order to deliver the UV light created by the UV lamps, it is very important to have a clean quartz sleeve. This will ensure that the UV light INTENSITY created by the lamp is not blocked by material built up on the quartz sleeve. In drinking water or wastewater application, it is commonplace that something will foul the UV quartz sleeve, be it Iron, Calcium (hardness), or Manganese. To help reduce fouling, the manufacturer that I work with has developed a patented chemical/mechanical wiping system that is effective in removing materials that may foul the quartz sleeves. The cleaning interval is site specific and can easily be identified if an intensity sensor is installed on the UV equipment. Given your site design parameters, a desired dose or intensity value will have been assigned, which will be exceeded in normal equipment operation. As your sleeves foul, this value will drop to a point nearing your designed minimum. This is usually an indication that cleaning is required, and, therefore, at this point, the equipment should be taken off-line and de-energized following lock-out/tag-out procedures for cleaning.

Further to the operation of most UV equipment, there will be a ballast to supply power to the UV lamp, an intensity sensor to ensure the proper amount of UV INTENSITY is reaching the water, and a control panel to provide the ‘brains’ of the operation. Each of these components will also require maintenance on an ongoing basis to ensure cleanliness and proper function and operation.

Responsibility of a service technician
As with every industry, there are responsibilities that tie in with service work. In the water and wastewater industry, given the events of the Walkerton tragedy in May of 2000, responsibility is something that is held in very high regard, and is usually at top of mind for myself and the other technicians. Whenever we walk onto a job site, the goal is to fix the problem in a timely fashion, satisfying the customer and ensuring that the UV equipment is functioning in a manner to provide the safest water possible.

As a service technician, I have dealt with a wide range of UV light maintenance over my 10 years. I have had the privilege to provide ultraviolet disinfection equipment service within the municipal and industrial water and wastewater industry. The pinnacle of my career thus far was in 2005 when I had the honour of commissioning the Trojan Ultraviolet Disinfection Equipment for Walkerton, Ontario as pictured in Fig. 4.
NEW REGULATIONS UNDER THE CLEAN WATER ACT SOURCE WATER PROTECTION POLICIES MOVE CLOSER TO REALITY

Juli Abouchar and Raj Bharati of Wills & Shier Environmental Lawyers LLP

Recent amendments to the regulations under the Clean Water Act flesh out which approvals and permits will be subject to the mandatory requirements of source protection plans, and set out new policy tools that source protection committees can use to protect drinking water sources. New detailed notice requirements are intended to ensure that all stakeholders have the opportunity to participate in the development of source water plans.

Background on the Clean Water Act

Previously in these pages, we have written about the Clean Water Act, 2006 (the ‘Act’).1 The Act is Ontario’s relatively new drinking water source protection legislation, which implements many of Justice O’Connor’s recommendations from the Report on the Walkerton Inquiry.

The Act creates source protection areas, which are generally co-terminous with one or more conservation areas, and establishes source protection committees for each of the source protection areas.2 The committees are composed of representatives of municipalities, the agricultural, industrial, commercial sectors, first nations, academics, non-government organizations and other members of the public.

Source protection committees have assigned the task of preparing assessment reports that are to describe the water resources in the source protection area, identifying vulnerable areas, and identifying activities and conditions that are or would be ‘drinking water threats’ or ‘significant drinking water threats.’ The general regulation under the Act3 enumerates activities that constitute drinking water threats. The list includes activities like the storage or application of road salt, handling and storage of organic solvents, and sewage handling activities.4

The committees must then develop source protection plans that contain policies to prevent any activity from resulting in any of the significant drinking water threats identified in the assessment reports.

Once a source protection plan is approved by the Ministry of the Environment (MOE), planning decisions made by municipalities (such as decisions relating to official plans and zoning bylaws), as well as decisions made by other branches of government (including boards, agencies and commissions) and must conform to the significant threat policies (and ‘have regard to’ the other policies) set out in the source protection plan. The Act provides that a provincial “decision to issue, otherwise create or amend a prescribed instrument shall conform with significant threat policies and ... have regard to other policies set out in the source protection plan.”5 The Province has made public the list of prescribed instruments in the new regulations (see below).

Even existing commercial, industrial and municipal operations that are identified as drinking water threats may be required to take protective measures to reduce discharges of contaminants, prevent spills, change chemical storage and handling practices, or otherwise reduce the risks of contaminating water supplies. The Act achieves this by requiring that “a person or body that issued or otherwise created a prescribed instrument before the source protection plan took effect shall amend the instrument to conform with the significant threat policies.”6

Finally, the Act also allows source protection committees to designate activities that are prohibited in an area’ and activities and land uses that must be regulated through risk management plans.7

New regulations provide more source protection policy tools

Since we first wrote about this topic, source protection committees have had their terms of reference approved by the MOE, and many have completed or are finalizing their assessment reports. Some are now developing significant threat policies and source protection plans.

Recently, significant and wide-ranging amendments were made to the General regulation under the Act.8 The regulatory amendments follow a policy paper released in summer 2009 and comments made through the Environmental Bill of Rights process on a draft regulation in winter 2010.

Highlights of these changes include the following:

• New categories of threats. The Act requires committees to address significant drinking water threats, but the regulation now also defines “low drinking water threats” and “moderate drinking water threats.”

• “Prescribed instruments” subject to plans defined. The regulation now lists the “prescribed instruments” that must comply (or have regard to) policies in source protection plans (see sidebar for a partial list). The MOE considered a wide range of instruments before settling on this list. Many were rejected if they were temporary or could not be amended, or because they were not considered to be an effective tool for source protection. Nonetheless, the regulation provides the MOE with the authority to add to the list of prescribed instruments.

• Source protection policy tools. We have described the main policy tools used by the Act:

  – mandatory compliance of planning decisions (official plan amendments, zoning bylaws, site plan agreements) with

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significant threat policies;  
– mandatory compliance of prescribed instruments with significant threat policies;  
– prohibiting certain activities in certain areas; and  
– mandatory risk management plans for certain activities in certain areas.

The regulation now empowers source protection committees to use other “soft” policy tools in source protection plans, in addition to the above mandatory policies. These policy tools include:  
– stewardship programs,  
– best management practices,  
– pilot programs and other research initiatives,  
– incentive programs,  
– education outreach programs,  
– meteorological and climactic data collection requirements, and  
– mandatory updating of spill prevention and contingency plans.

- **Notice requirements.** Source protection committees must now give formal notice that they have begun preparing their source protection plan to municipalities, First Nations, and anyone who the committee believes would be engaging in an activity that would be significant to drinking water. If your organization receive such a notice, consider it the start of the consultation process. Further notice will be required to affected parties as source protection plans and policies are developed.

- **Consultation requirements.** Source protection committees will be required to publish a draft of their proposed source protection plan before it is submitted for governmental approval. Notice that the draft plan has been created must be distributed widely, and the committee must hold at least one public meeting to give members of the public an opportunity to ask questions and to make comments.

- **Exemptions to prohibited and regulated activities.** The regulation exempts certain activities from some of the source protection regulatory tools available under the Act. Waste disposal sites with approvals under the Environmental Protection Act and sewage systems with approvals under the Ontario Water Resources Act or regulated by the Ontario Building Code are exempt from risk management orders, prohibitions and restricted land use tools under the Act.

The Act and regulations now authorize a variety of approaches and tools that can be used to ensure that an activity does not become (or ceases to become) a significant drinking water threat.

**End notes**

2. Some source protection areas are consolidated into source protection regions.
3. O. Reg. 287/07.
4. O. Reg. 287/07, s. 1.1.
5. Section 39(7).
6. Section 43(1).
7. Section 57(1). Existing activities that are prohibited will have at least 180 days to be phased out; s. 57(2).
8. Sections 58(1) and 59(1).
10. O. Reg. 287/07, s. 26.
11. See O. Reg. 287/07, ss. 35-39.
12. O. Reg. 287/07, s. 41.

Juli is an Environmental Law Specialist certified by the Law Society of Upper Canada. She was Assistant Commission Counsel to Justice O’Connor during the Walkerton Inquiry, serves as a member of the CTC Source Protection Committee and is a Director of the Ontario Clean Water Agency.

Raj is an Associate Lawyer with a degree in environmental engineering.

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**Some ‘prescribed instruments’ that must conform to significant threat policies**

**Environmental Protection Act**
- Certificates of approval for waste disposal sites
- Certificates of approval for waste management systems
- Renewable energy approvals

**Ontario Water Resources Act**
- Permits to take water
- Certificates of approval for sewage works

**Safe Drinking Water Act**
- Drinking water works permits
- Municipal drinking water licences

**Pesticides Act**
- Permits for land exterminations, structural exterminations and water exterminations

**Aggregate Resources Act**
- Licences for pits and quarries and associated site plans
- Aggregate permits and wayside permits and associated site plans

**Ministry of Agriculture, Food and Rural Affairs**
- Nutrient management strategies and plans
- Non-agricultural source material plans
BIRTHDAY WISHES FOR SAFE WATER NEW PROFESSIONALS GATHER TO CELEBRATE, AND SUPPORT A GOOD CAUSE

Bill White, P.Eng. CH2M HILL

If one thing is inevitable in life, it is getting older. Everyone has mixed feelings about it, but now Water For People – Canada (WFP-C) can help give some special meaning to the occasion. By hosting a Water For People party, the gifts of your guests can help bring clean water and sanitation to people in the developing world, who desperately need it.

One Saturday this past January, 30 people, many of them members of the WEAO New Professionals (NPs) Committee, met to celebrate the birthday of one of their own. The NP explains, “I am very lucky - there is not much I need to make a great company, besides the company of good friends. This was a way to give a gift to people who really needed it.”

Planning a WFP-C benefit is quite simple: make sure your friends know the location well in advance, and that the event will be a fundraiser for WFP-C. Online invitations can direct guests to the WFP-C website, and ask them to make a small donation in lieu of gifts. With the permission of the host or venue management, a basket can also be placed in a prominent location, together with WFP-C literature. Brochures are available on the WFP-C website, along with contact information. Many of the guests were impressed with Water For People’s approach to building local capacity as well as basic infrastructure. For a lot of the guests, this was the first time they had heard of Water For People.

Water For People – Canada is also enthusiastic about this opportunity. According to WFP-C Public Relations Coordinator Louise Hollingsworth, this is a good way to raise awareness and funds at the same time. It is not about the amount of money raised, Hollingsworth explains, but about spreading information: “Now, if you have two friends and they tell two friends, and so on and so on – it is a great idea.” The idea is not a new one, Hollingsworth explains. Other charities also encourage this type of event.

Holding a WFP-C birthday does not need to be entirely altruistic, either. As one NP explains: “It is simple, really – the idea grew out of a desire to do something for people – that, and a fervent hope that I would not get any of the gag gifts that usually come at a thirtieth birthday!”

For more information: Water For People – Canada: www.waterforpeople.org/about/offices/water-for-people/canada

Keeping a global perspective: donations from party guests provide safe water and sanitary facility for thousands of people in the developing world.

WEAO NPS AND STUDENTS SET NEW WFP FUNDRAISING HIGH

Bill White, P.Eng. CH2M HILL

Even Water For People volunteers can get tired of the rain. With a good cause, though, even thunder showers were not enough to dampen the spirits of seven enthusiastic student members and New Professionals (NPs) at the 2010 OPCEA golf tournament.

When OPCEA’s Board of Directors offered WEAO’s Water For People-Canada (WFP-C) Committee the opportunity to run the 50/50 draw and putting challenge at their annual tournament, the NPs were quick to take up the challenge. Four NPs and three students from the Ryerson and Windsor student chapters teamed up to run the WFP-C Committee’s most successful fundraiser to date at the OPCEA tournament.

Even a break in play to let lightning pass did not deter the students – when the horn sounded, they moved inside to sell 50/50 tickets. Vanessa Chau of the Member Services Committee was especially energetic in her sales, while the students from Ryerson and Windsor put a friendly face on the recruiting for the putting challenge. The day was finished off with a chance to tell our new friends at the banquet about the good work done every day around the world by Water For People.

With matching funds generously provided by the OPCEA Board, the event raised over $3,000, which will be used to provide effective sanitary facilities and safe drinking water in our partner countries in the developing world. Special thanks go to the OPCEA Board for their kind generosity and encouragement.
CWWA FACES NEW CHALLENGES

By John Duong, M.Eng, P.Eng, CWWA Director

For those of you who are not aware, the Canadian Water and Wastewater Association (CWWA) is a non-profit national body representing the common interests of Canada’s public sector municipal water and wastewater services and their private sector suppliers and partners. CWWA is recognized by the federal government and national bodies as the national voice of this public service sector.

CWWA held its spring meeting in Kelowna, BC from May 18-20, 2010. Beautiful weather greeted us in the morning of the first day and rapidly disappeared over the lush green mountains of Kelowna for the remainder of the stay. Of course, back home in Toronto, everyone was experiencing a heat wave of 25 degree temperature. That is just my luck.

As the new WEAO CWWA Board executive, the spring Board meeting was my first exposure to CWWA Board activities. Prior to the meeting, a glimpse of what was ahead came to me in three separate meeting agenda documents, each of which were 63, 21 and four pages, respectively, or a total of 84 pages. The meeting was an eye-opener for me. The CWWA Board should be commended for its structure and the amount of work that gets completed at the two and a half day spring meeting.

To no surprise, the meeting consisted of numerous, but important topics, including discussion around BCWWA’s presentation on ‘One Voice for Water’ in Canada. Currently, there is a strong connection between WEF and AWWA with its member associations in Canada, but there is a lack of linkages east-west to effectively impact government policies, public awareness and research priorities. To foster a more streamlined and effective communication between CWWA and the Canadian WEF and AWWA Member Associations, a meeting is scheduled to take place in the spring of 2011.

The CWWA Board had a discussion on membership fees and it was decided that there will be a 2% increase over 2010 rates, in order to ensure sustainability. There was also consensus by the Board to expand CWWA’s depth and representation of matters into stormwater management.

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After 16 years of leading and shaping the organization to where it is today, Duncan Ellison retired as executive director on August 2, 2010. Duncan is looking forward to enjoying the next chapter of his life with his wife Lorraine. On behalf of the Board, please join me in thanking Duncan for all the great years as executive director for CWWA and wishing him all the best in his new adventures.

A new Executive Director Search Committee was struck at the December Board meeting in Ottawa. A thorough search was undertaken by this committee for the first half of the year and the Board is happy to announce the appointment of Jennifer Jackson as the new CWWA executive director. Jennifer comes to us with a biological sciences and law background as well as various environmental and municipal governance experiences. At the City of Ottawa, Jennifer provided direction on the Municipal Act, practiced environmental law, and was involved in waste management policy development and funding. In her most recent capacity, she worked as a policy analyst for the Environmental Stewardship Branch with Environment Canada.

In the news
Since the draft regulation for wastewater effluent was published under the Fisheries Act on March 20, 2010, CWWA has been actively working with its Wastewater and Stormwater Committee to develop and submit detailed comments to the federal government. The CWWA Wastewater Committee members have been extremely diligent in making, compiling, and reviewing comments from its members. The Position Statement and full comments can be found at http://www.cwwa.ca/FisheriesRegulation.asp. Following the receipt of comments from CWWA, other organizations and municipalities, the federal government has elected to listen to the issues at hand. Most recently, CWWA has engaged staff from Environment Canada to discuss concerns and possible modifications to the proposed Regulations. Future meetings are planned with senior staff of Environment Canada to discuss how this regulation can be practically implemented.

Upcoming events
As a partner with the Canadian Association for Water Quality in the International Water Association’s Canadian National Committee, CWWA has been active in the planning for the Montréal 2010 World Water Congress. CWWA will be present at the Congress, from September 19-23, 2010, by supporting the Canadian Utilities booth at the exhibition. This is a sponsorship of the Congress by the five largest water utilities in Canada. CWWA will also be active in the North American Regional Day program of workshops that will be run in parallel to the regular sessions and workshops. CWWA is organizing/featuring a workshop on low temperature operations that will take place on the first day of the Congress.

The annual Window on Ottawa conference will take place from December 1-2 at the Crowne Plaza Hotel in downtown Ottawa. The conference will be preceded with two workshops on November 31: a water security workshop and a biogas workshop. The topic of water utility security has been featured in conjunction with the Window on Ottawa for several years now, and will build on previous years’ topics. This workshop will be fully sponsored by Public Safety Canada. The biogas workshop will focus on biogas and its potential as an energy source for municipalities. For more information or to register for the conference, please visit the CWWA’s website at www.cwwa.org.

CWWA has engaged staff from Environment Canada to discuss concerns and possible modifications to the proposed Regulations.
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<td>C &amp; M Environmental Technologies Inc.</td>
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<td><a href="http://www.cmeti.com">www.cmeti.com</a></td>
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<td>C.C. Tatham &amp; Associates Ltd.</td>
<td>705-444-2565</td>
<td><a href="http://www.cctatham.com">www.cctatham.com</a></td>
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<td>Cancoppas Limited</td>
<td>800-595-0114</td>
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<td>Claessen Pumps Ltd.</td>
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<td>HETEC Solutions Inc.</td>
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<td>Hollen Controls Limited</td>
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