Canadian Water Network

#CWNSYP Webinars

September 15, 2021
Insights for the Water Sector

1. Identify opportunities to catalyze progress and accelerate success
2. Frame what is known and unknown into useful, actionable insights
3. Shape important conversations on water policy and practice
Join the conversation! #CWNSYP

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Webinar Speakers

Saif Molla
Manager of Planning & Engagement
EPCOR Gold Bar Wastewater Treatment Plant

Kim Alcorn
Process Safety Engineer
EPCOR Gold Bar Wastewater Treatment Plant

Pedro Gochicoa
Territory Manager
Xylem Inc.
Water Reuse
A Gold Bar WRRF Perspective

CWN SYP Webinar
2021-Sep-15
K. Alcorn and S. Molla
Gold Bar WRWF
Water Reuse

**What?**
- Reclaim water from various sources
- Treat water
  - Can be regulated based on the reuse purpose
- Reuse water for beneficial purposes (Examples)
  - Agriculture and irrigation
  - Potable water supplies
  - Groundwater replenishment
  - Industrial processes
  - Environmental restoration

**Why?**
- Mainly a consideration for areas with water shortages
### Water Reuse Examples - Alberta

<table>
<thead>
<tr>
<th>Plant</th>
<th>Treatment</th>
<th>End Uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gold Bar WWTP</td>
<td>BNR, membrane filtration, chlorination</td>
<td>Suncor Refinery</td>
</tr>
<tr>
<td>Alberta Capital Region Wastewater Commission WWTP</td>
<td>BNR, UV disinfection</td>
<td>Fire-fighting, irrigation</td>
</tr>
<tr>
<td>Bonnybrook WWTP (Calgary)</td>
<td>Secondary effluent (no filtration), ammonium sulphate, sodium hypochlorite, strainers</td>
<td>Cooling water makeup at ENMAX Shepard Energy Centre, washdown</td>
</tr>
<tr>
<td>Pine Creek WWTP (Calgary)</td>
<td>Disk filtration, UV disinfection, chlorination</td>
<td>Washdown, pump seal, cooling, flushing, polymer dilution, toilet flushing, priming floor drain traps</td>
</tr>
<tr>
<td>Fish Creek WWTP (Calgary)</td>
<td></td>
<td>Washdown, service water</td>
</tr>
<tr>
<td>Red Deer WWTP</td>
<td>UV disinfection (no filtration)</td>
<td>Washdown, service water</td>
</tr>
<tr>
<td>Lethbridge WWTP</td>
<td></td>
<td>Washdown, service water</td>
</tr>
<tr>
<td>Wood Buffalo WWTP</td>
<td>BNR, UV disinfection, chlorination</td>
<td>Washdown, service water</td>
</tr>
</tbody>
</table>
Gold Bar Water Systems

- Four (4) water systems
  - Utility water
  - Final effluent
  - Potable water
    - Will not replace with reuse water
  - Membrane product water
    - Used exclusively by Suncor and Air Products
Utility Water End Uses

- Total UW use
  - Consistent demand
  - 22 L/s (1,900 m³/d)

- Main users
  - Compressors → 42%
  - Boilers → 24%
  - Seal water → 15%
  - Heat exchangers → 9%
  - Other → 10%
Final Effluent End Uses

- Average FE demand (intermittent)
  - 99.5 L/s (8,578 m³/d)

- Main users
  - Flushing process units/equipment → 69%
  - Continuous flush of primary channel → 16%
  - Fermenter elutriation water → 5%
  - Other → 10%
AEP is currently developing a recycled water regulation. Regulations’ main components will likely include:

- AEP will issue approvals for all reuse applications
- Regulation will cover reuse of municipal WW effluents only
- Allowable end-uses and treatment requirements will be standardized and codified
- Filtration and disinfection requirements expected to be similar to other jurisdictions
- Treatment requirements will vary according to the application
# Treatment Levels

<table>
<thead>
<tr>
<th>Uses</th>
<th>Average Flow (L/s)</th>
<th>Peak Flow (L/s)</th>
<th>Turbidity Target (NTU)</th>
<th>Disinfection Target (MPN/100 mL)</th>
<th>Chlorine Residual Required</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disinfected Tertiary</td>
<td></td>
<td></td>
<td>&lt; 2 NTU (as specified by Title 22)</td>
<td>5-log removal and TC &lt; 2.2 MPN / 100 mL (as specified by Title 22)</td>
<td>Yes</td>
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<tr>
<td>• Screen washdown</td>
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<tr>
<td>• Sprayers</td>
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<td>• Flushing</td>
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<td>• Fire fighting</td>
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<td>• Toilet flushing</td>
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<td>• Additional 10 L/s for future demand</td>
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<tr>
<td>Secondary-23</td>
<td></td>
<td></td>
<td>&lt; 2 NTU (governed by mechanical requirements of equipment)</td>
<td>TC &lt; 23 MPN / 100 mL (as specified by Title 22)</td>
<td>Yes</td>
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<tr>
<td>• Dust Control</td>
<td>20</td>
<td>20</td>
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<tr>
<td>• Heat exchanger</td>
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<tr>
<td>• Seal water</td>
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<tr>
<td>• Sediment Traps</td>
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<tr>
<td>• Odour control scrubbers</td>
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<td>• Polymer preparation</td>
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<tr>
<td>• Boiler feed water make-up</td>
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<tr>
<td>• Bio-methane gas scrubber (future)</td>
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<tr>
<td>Existing FE</td>
<td></td>
<td></td>
<td>&lt; 10 NTU (governed by mechanical requirements of equipment)</td>
<td>None</td>
<td>Yes</td>
</tr>
<tr>
<td>• Flushing</td>
<td>100</td>
<td>250</td>
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<tr>
<td>• Fermenter elutriation water</td>
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<tr>
<td>• Grit recovery facility</td>
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<td>• Screen wash at grit tanks</td>
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<td>• DAF polymer carrier water</td>
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</tbody>
</table>
## Treatment Options

<table>
<thead>
<tr>
<th>Filter Options</th>
<th>Disinfection Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disc: Cloth-Media or Stainless</td>
<td>Chlorine</td>
</tr>
<tr>
<td>Granular Media</td>
<td>Ultraviolet</td>
</tr>
<tr>
<td>MF/UF Membrane</td>
<td>Ozone</td>
</tr>
</tbody>
</table>
Summary

- Diverting 5% of daily flow from river to reuse water customers
- Continue to maintain and use FE system for plant applications
- Plans in place to expand water reuse on site and for external customers
Questions?
Contact

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Xylem’s Technologies and Water Reuse Applications

Canadian Water Network
September 14, 2021

Pedro Gochicoa – Territory Manager, Xylem
Water Reuse Around Us
Potable and Non-Potable Reuse

Non-Potable Reuse (NPR)

Indirect Potable Reuse (IPR)

Direct Potable Reuse (DPR)

Xylem’s Approach to Water Reuse
Xylem – Encompassing the Entire Cycle of Water

Transport → Treat → Test → Reuse + Analytics: Enabling & Optimizing Water Use
The Xylem Family

Biological Wastewater Treatment
Diffused Aeration
Sequencing Batch Reactor
Oxidation Ditches
Process Controls

Dry and Submersible Pumps
Mixers
Mechanical Aeration

Gravity Media Filtration
Clarification
Dissolved Air Flotation
Ozone-enhanced Biologically Active Filtration

Ultraviolet Disinfection
Ozone Oxidation
Advanced Oxidation Process
Xylem Reuse Solutions

- Wedeco UV Disinfection
- Wedeco Ozone Generators
- Wedeco Advanced Oxidation Processes
- Leopold Media Filters
UV Systems
UV Case Study: Rio de Flag WRF, AZ

- Duron open channel UV system
- 630 m³/h (4 MGD) NPR facility with a 100 mJ/cm² UV dose
- Effluent used for golf course irrigation, snow making in winter
UV Case Study: Silicon Valley WD, CA

- 12 LBX closed-vessel UV Units, 1577 m³/h (10 MGD), UV dose 80 mJ/cm²
- Variable Design & Control to Treat MF or RO effluent
- UV/H₂O₂ Pilot > Future upgrade to UV-AOP
- Winner of 2015 Water Reuse Project of the Year
- Urban NPR: irrigation, landscaping, industry

Silicon Valley Advanced Water Purification Center
Ozone Systems
Ozone Characteristics

- Colorless gas formed when O2 molecules split within an electric field
- Relatively short half life (cannot be transported or stored – must be generated at point of use)
- Very powerful oxidizing agent
  - Oxidation: Color, T&O, particle removal, algae control
  - Disinfection: giardia, crypto, viruses
Ozone Case Study: Los Angeles, CA

- Demonstration facility at DC Tillman WRF using ozone to destroy CECs
- 1,577 m³/h (10 MGD) capacity, treating secondary effluent
- Water goes to spreading grounds for aquifer recharge
Ozone + BAF Solution

1. Oxidation

2. Filtration & Biological Treatment

3. Sensors and Integrated Process Control

① Inactivation of Pathogens & Oxidation of Organics
② Removal of TSS and Turbidity
③ Destruction/Removal of TOC, CECs, and DBPs
Ozone-BAF Case Study: HRSD SWIFT Facility

- Winner of US Water Prize
- 158 m³/h (1 MGD) Demonstration Facility
  Scope: Oxelia Integrated Ozone & BAF
  - 2 x SMOevo 610 Ozone Generators at 200 PPD each
  - 4 x Filter Cells with XA Underdrain
Advance Oxidation Processes

MiPRO photo

Components:
- WEDECO UV system
- H₂O₂ dosing unit

Application
- Especially photosensitive substances are reduced effectively, i.e. NDMA
- Compact footprint

Advantages:
- Additional disinfection of the water by UV light

UV + Hypochlorite + UV + Peroxide

Water In

H₂O₂ Injection Static Mixers UV-System
Advance Oxidation Processes

**Components:**
- WEDECO Ozone system
- $\text{H}_2\text{O}_2$ dosing unit
- Injection / reaction unit
- Residual Ozone Destruction system

**Application:**
- Most appropriate when pollutants are degraded effectively by the radical reaction path

**Advantages:**
- Favourable operating costs
- Suitable for a wide range of substances

**Ozone + Peroxide**
Some compounds are not strippable, absorbable or biodegradable.
Some are regulated (either at a federal or state level) or are candidates for future regulations
AOP is often the best solution to destroy these types of compounds of concern.

<table>
<thead>
<tr>
<th>Contaminant of Concern</th>
<th>Typical Source</th>
<th>Regulated?</th>
</tr>
</thead>
<tbody>
<tr>
<td>1,4-Dioxane</td>
<td>Solvent stabilizer, found in groundwater from past industrial releases</td>
<td>Yes (some states)</td>
</tr>
<tr>
<td>NDMA</td>
<td>Found in groundwater from past industrial releases, or formed in wastewater plants</td>
<td>Yes (some states)</td>
</tr>
<tr>
<td>Atrazine</td>
<td>Herbicide, found in surface water bodies from agricultural runoff</td>
<td>Yes</td>
</tr>
<tr>
<td>MIB &amp; Geosmin</td>
<td>Taste &amp; odor compounds found in drinking water from harmful algal blooms</td>
<td>No, but a nuisance to customers</td>
</tr>
<tr>
<td>Endocrine Disrupting Compounds (EDCs)</td>
<td>Found in wastewater from human use</td>
<td>No, but under consideration</td>
</tr>
<tr>
<td>Pharmaceutical and Personal Care Products (PPCPs)</td>
<td>Found in wastewater from human use</td>
<td>No, but under consideration</td>
</tr>
<tr>
<td>Industrial Micropollutants including VOCs</td>
<td>Chlorinated Solvents, Petroleum Hydrocarbons, Fuel Additives, Phenols</td>
<td>Yes</td>
</tr>
</tbody>
</table>
Case Study: Terminal Island WRF, CA

- Tested 6 different AOPs: Ozone vs UV; MP vs LPHO UV; and H2O2 vs NaOCl
- World’s first greenfield UV AOP system using sodium hypochlorite as an oxidant
- 2017 ENR Best of the Best Water/Environment Project
- Indirect Potable Reuse (MF>RO>UV-AOP)
- Scope: 1st Greenfield MiPRO UV/Cl2 AOP for 1,890m³/h (12 MGD)
  - 2 x K143 12-17 UV Reactors
• Xylem’s water solutions are ready for reuse
• Piloting is predicting the full scale performance very accurately
• Xylem’s piloting fleet helps defining the optimal, site-specific full scale design
• All our efforts will make the cost of reuse water equal to that of new raw water supply
Thank you!

For questions please contact:

Pedro Gochicoa pedro.gochicoa@xylem.com
CWN SYP thanks our invited speakers

Saif Molla  Kim Alcorn  Pedro Gochicoa

And thank you to all attendees for participating!
A recording of this #CWNSYP webinar will be available next week: cwn-rce.ca/events/webinars/student-and-young-professional-webinars/