



Summary of Insights

Managing Risks from Contaminants of Emerging Concern in Wastewater

Canadian Municipal Water Consortium Strategic Sharing Group



October 2018 to August 2020



Acknowledgements

Canadian Water Network (CWN) thanks the utility leaders from twelve municipalities across Canada who participated in this inaugural Strategic Sharing Group. Their feedback has helped shape future groups and was particularly valuable at the outset of the COVID-19 pandemic. CWN also thanks the experts who generously shared their leading knowledge with the group.

Glossary

For the purposes of this report, the following definitions were used:

Contaminants in wastewater refers to pathogens, nutrients, metals, chemicals and physical constituents generated or concentrated by society, which can potentially pose adverse effects on receiving environments and public health.

Contaminants of emerging concern (CECs) refers to non-conventional contaminants that have been, or will be, detected in wastewater effluents, and for which the potential risks to public and environmental health are not yet fully understood. For example, these include trace organics such as endocrine-disrupting substances (e.g. estrogens) and pharmaceuticals and personal care products (PPCPs), as well as nanoparticles and microplastics. These contaminants have also been referred to in various sources as emerging contaminants, emerging substances of concern, trace contaminants, micropollutants or microcontaminants.

The Canadian Municipal Water Consortium's Strategic Sharing Groups provide meaningful peer-to-peer sharing opportunities on emerging issues. Canadian Water Network facilitates an environment for confidential dialogue among participating senior utility managers, and where appropriate, invites leading experts to share their knowledge. The discussion is directed by the group and the support of CWN staff, who frame the issue, facilitate discussions, invite relevant guest experts, incorporate insights from the international community, create meeting captures and use critical takeaways and learnings to shape future Consortium initiatives to support the municipal community.



Background

In 2018, CWN conducted a national expert panel review of contaminants in municipal wastewater and Canada's options to empower decision makers and stakeholders to choose the most effective treatment investments, policies and practices. The panel's final report, [Canada's Challenges and Opportunities to Address Contaminants in Wastewater](#), covers the full spectrum of contaminants in wastewater, but provides some baseline context on the CECs that Canadians are concerned about, as well as the regulatory support and guidance available for dealing with potential risks of a long and growing list of CECs.

This is a growing field of study, and individual researchers and research organizations are advancing the science of CECs — in terms of the risks they present individually and as complex mixtures in wastewater effluent discharged to the environment, as well as viable risk mitigation options. However, it should be noted that across Canada there is no coordinated regulatory guidance on how municipalities and utilities should manage risks from CECs.

The federal Wastewater Systems Effluent Regulations (WSER) include only four constituents — suspended solids, carbonaceous biochemical oxygen demand, total residual chlorine and un-ionized ammonia. However, provinces and territories have the authority to implement additional or more stringent wastewater effluent requirements. For example, British Columbia and Alberta have surface water quality guidelines on a wide range of contaminants, including CECs, although they are not legally enforceable.

The Canadian Environmental Protection Act (CEPA) can contribute to improved wastewater effluent quality by controlling the use of substances that are difficult to treat. The Chemicals Management Plan under CEPA includes monitoring and surveillance of certain chemicals in the environment. Across Canada, 20 municipalities with a range of wastewater treatment facilities are involved in this federal program. The samples of wastewater and solids collected at various stages of treatment are tested for conventional parameters and priority substances, metals and trace organics. The results provide insight on the removal of various substances through a variety of treatment processes, although this has yet to be translated into broad-based actionable information for municipalities and utilities across Canada.



Overall, greater clarity is needed regarding priority CECs and the optimal technologies and treatment processes to achieve their removal. To continue to drive progress on this important issue, CWN launched an inaugural Strategic Sharing Group in October 2018 with twelve municipal and utility decision makers from the Canadian Municipal Water Consortium's leadership group. Seven meetings were held to accomplish the following objectives:

1. Explore strategies for managing risks associated with CECs in wastewater discharge.
2. Learn from other utilities about challenges encountered and what work is underway.
3. Advance the development of utility management strategies and best practices.

Several leading experts were invited to share their knowledge with the group:

- *Region of Waterloo Surface Water Quality Monitoring Program*, Trevor Brown, Manager of Wastewater Operations, Region of Waterloo
- *Assessment of Environmental Risks Related to Emerging Contaminants in Municipal Wastewaters*, Karen Kidd, Professor, School of Geography and Earth Sciences, and Department of Biology, McMaster University
- *Review of the Canadian Aquatic Biomonitoring Network (CABIN) and Opportunities for Municipalities*, Tim Pascoe, Environmental Scientist, Water Quality Monitoring and Surveillance, Environment and Climate Change Canada
- *Research to Practice – Own your Data, Own the Discourse*, Lisa Ragain, Principal Water Resources Planner, Metropolitan Washington Council of Governments
- *Monitoring Chemical Substances in Canadian Municipal Wastewater*, Shirley Anne Smyth, Unit Head for Wastewater Science, Environment and Climate Change Canada

CEC Strategic Sharing Group Overview

The Strategic Sharing Group participants held a range of municipal and utility experience. The meetings covered a range of topics directed by the group's interests and needs:

Table 1: Overview of Strategic Sharing Group discussion topics

<p><u>Meeting 1: Understanding key challenges and knowledge gaps</u></p> <p>Maturity of utility risk management and monitoring programs, regulatory guidance for CEC management, cocktail effect of multiple CECs, effective use of data, improving literacy on CECs internally and publicly.</p>
<p><u>Meeting 2: Municipal wastewater monitoring plans for CECs</u></p> <p>Effective sampling approaches, national regulations, Environment and Climate Change Canada's national monitoring program, mixtures and cumulative effects of CECs, monitoring frequency and parameters, rationale for monitoring.</p>
<p><u>Meeting 3: Risk management methods beyond monitoring plans</u></p> <p>Drivers for risk management, developing source water protection plans, managing CEC loadings from industrial/commercial entities, coordination of risk management efforts, lack of regulation as a key barrier, public communications initiatives, improving internal understanding and engagement on CECs.</p>
<p><u>Meeting 4: Internal and public communication challenges and strategies</u></p> <p>Elements and approaches of a strong risk communication strategy, evaluation strategies, the importance of public discourse, effective public messaging.</p>
<p><u>Meeting 5: Using effects-based monitoring & biomonitoring to prioritize management actions</u></p> <p>Monitoring surface water near wastewater treatment plants, examining impacts to aquatic species, designing locally specific effects-based monitoring and biomonitoring approaches, sampling protocols and effective technologies.</p>
<p><u>Meeting 6: A deeper dive on effects-based monitoring and biomonitoring</u></p> <p>Canadian Aquatic Biomonitoring Network program, standard protocols for biomonitoring, access to biomonitoring data, resources and methodologies, co-benefits of biomonitoring, optimal sampling seasons/times.</p>
<p><u>Meeting 7: CECs monitoring programs during the COVID-19 pandemic</u></p> <p>Impacts of COVID-19 to management and monitoring programs, modification of sampling procedures because of COVID-19 provincial guidelines, funding priorities, critical partnerships with universities, microplastics and PFAs in wastewater.</p>



Insights and Strategies for Managing CECs in Wastewater

The Consortium's CECs Strategic Sharing Group wrapped up with a final meeting on August 5, 2020. Here are some of the key insights that emerged during the discussions:

- Historically, the drivers to monitor CECs at the municipal level have varied — e.g. test sites for Environment and Climate Change Canada's national monitoring program, research or partnerships with local universities, or as a component of other projects.
- The absence of federal and provincial regulation on emerging contaminants has been a key barrier in implementing source control measures and targeting the removal of CECs in wastewater treatment plants. This gap has led to challenges in obtaining public buy-in and support from city councils to allocate the resources and funding needed for CECs programs.
- Better assessing the toxicity of CECs to the environment and human health is an ongoing challenge. There is a need to quantify the concentration of individual CECs, as well as the 'cocktail effect' of CECs in receiving waters. As these knowledge gaps are addressed, utilities can develop a stronger case for more stringent monitoring and management.
- The Government of Canada's Chemical Management Plan expires in 2020. After this date, the plan will evolve from a chemical-by-chemical approach to look at mixtures of a variety of different chemicals together, including the cumulative effects of these mixtures.
- Effects-based monitoring and biomonitoring are promising approaches that could complement standard chemical monitoring programs. Effects-based and biomonitoring testing methods, sampling protocols and effective technologies are generally in the early stages of development. As such, these approaches have yet to see widespread adoption by municipalities and utilities. Collaboration across utilities and between multiple levels of government could help ameliorate this and initiate discussion on potential standards and guidelines.
- A consistent and evidence-informed sampling program is the core of a strong CECs monitoring program. Monitoring program development requires first establishing an understanding of baseline water quality and aquatic health. Sampling methods should be carefully selected, as they affect the results obtained. Monitoring results can, over time, help demonstrate the business case for and benefits of WWTP upgrades.



- Monitoring surface water upstream and downstream of WWTPs, as well as examining the differences between areas of high concern and low concern is a useful approach to determining and tracking impacts to aquatic species. This might help better manage 'unknown unknown' risks. Identifying suitable reference sites will help facilitate more accurate comparative analyses of the results.
- The characteristics of each WWTP and receiving environment varies and each site is host to a unique biological community. As a result, each monitoring program will need to consider these factors in the design of an effects-based monitoring and biomonitoring approach.
- To yield accurate, valuable and locally specific results, sampling protocols and frequency should be selected based on the intended purpose of sampling (e.g. seasonal variance, temporal change, benthic data, change over time). Optimal sampling time is typically from late August to late October because it avoids impacts from high water and base flow.
- Environment and Climate Change Canada is collaborating with partners across the country through the Canadian Aquatic Biomonitoring Network (CABIN) program to expand coverage and provide access to biomonitoring data, standard protocols, resources and methodologies. Utilities can make use of the standard protocols, resources and methodologies developed under CABIN to guide the development of their own biomonitoring programs. Utilities can also access the data to further their understanding of potential downstream impacts of wastewater discharge to the aquatic community.
- Most of the utilities profiled during the group discussions are still assessing how to use the results obtained from their monitoring plans to inform new treatment technologies, treatment plant optimization and risk management strategies (e.g. source control measures).
- In some cases, monitoring programs developed to meet one main objective may end up yielding broader benefits (co-benefits) that inform decision-making on wastewater treatment and investments and offer insights for challenges such as CECs.
- Municipalities continue to face challenges in communicating information on CECs. To be proactive, some utilities have created awareness campaigns to inform residents on what can and cannot be sent into the sewer network. Some are also working to implement take-back programs with local pharmacies to encourage proper disposal of pharmaceuticals.



- The COVID-19 pandemic has highlighted the need for ongoing communication and coordination with industry to ensure they are aware of the potentially immediate impacts that changes to their operations may have on wastewater treatment processes.
- Securing the funding needed to start or continue to support CECs monitoring and management continues to be a challenge, particularly given the shift in research funding after the COVID-19 pandemic was declared in March 2020.

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