



Canadian
Water
Network

CONFIDENTIAL

Insights and Strategies for Managing Risks from Contaminants of Emerging Concern in Wastewater

Canadian Municipal Water Consortium Strategic Sharing Group



October 2018 to August 2020

Contents

Overview	2
Meeting 1: Understanding Key Challenges and Knowledge Gaps	3
Meeting 2: Municipal Wastewater Monitoring Plans for CECs.....	4
Meeting 3: Risk Management Methods beyond Monitoring Plans	7
Meeting 4: Internal and Public Communication Challenges and Strategies	10
Meeting 5: Using Effects-Based Monitoring and Biomonitoring to Prioritize Management Actions....	12
Meeting 6: A Deeper Dive on Effects-Based Monitoring and Biomonitoring	13
Meeting 7: CECs Monitoring Programs during the COVID-19 Pandemic	16
Appendix 1: Strategic Sharing Group – Participating Utilities	18

CONFIDENTIAL

The Canadian Municipal Water Consortium's Strategic Sharing Groups provide meaningful peer-to-peer sharing opportunities on emerging issues. Canadian Water Network (CWN) 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's participants, with support from 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 to shape future Consortium initiatives to support the municipal community.

In October 2018, Canadian Water Network launched a pilot strategic sharing group for members of the Canadian Municipal Water Consortium's leadership group (CLG). This inaugural strategic sharing group focused on strategies for managing risks from contaminants of emerging concern (CECs) in wastewater discharge, including monitoring, treatment and other policies. This insights report, as well as the group's meeting agendas, primers, presentations, and meeting captures are available on the CLG members area of the website and by request at info@cwn-rce.ca. To protect the spirit of openness in these groups, **please treat these documents as confidential** and use your discretion when sharing within your organization due to the potential sensitivity of the information.

The meetings covered a range of topics directed by the participants' interests and needs. Information was shared on contaminant status, sampling and monitoring strategies, regulatory needs, risk management policies and risk communication. The participants (Appendix 1) brought a range of municipal and utility experience to the CEC Strategic Sharing Group. Several leading experts were also invited to share their knowledge with the group. CWN hosted seven meetings from October 2018 to August 2020 with the following overall objectives:

1. Explore strategies from managing risks associated with contaminants of emerging concern (CECs) in wastewater discharge.
2. Learn from leading utilities across Canada about what work – formal or informal – is underway on this topic and identify common challenges.
3. Advance the development of utility management strategies and best practices in Canada.

Meeting 1: October 24, 2018

Understanding Key Challenges and Knowledge Gaps

[Agenda and Primer](#)

[Meeting Capture](#)

Meeting Objectives

1. Discuss the group's objectives, structure and mode of communication and other rules of engagement.
2. Develop a basic understanding of the challenges and gaps in this space. CWN facilitated this discussion by posing key, high-level questions (see [Agenda](#)).

Key Insights

Overall, the utilities participating in the CEC Strategic Sharing Group are at various stages of risk management and monitoring program development. Some utilities are in the initial stages of considering how to manage risks and which CECs to target, while others have implemented comprehensive monitoring plans.

- Key challenge: lack of regulatory guidance
- Knowledge gap: Several questions were raised by the group concerning monitoring
 - Is there a harmonized approach to characterization and monitoring? Where should entry-level utilities start when developing a characterization program?
 - What are the benefits of chemical monitoring of individual CECs versus biomonitoring? What is the best approach to conduct biomonitoring?
 - What are the merits of outsourcing CECs testing versus using in-house equipment? A primary challenge is that many private labs do not have tests available for all CECs.
- Knowledge gap: how data collected on CECs can be used
 - Detecting compounds is only one half of the equation; the other half is determining their effects.
 - There is a need to not only quantify individual CECs, but also assess the 'cocktail' effect of multiple CECs. The province of Quebec is currently doing this.

- Key challenge: Internal and external communications
 - Should utilities be sharing their monitoring results for CECs with the public, and if so, then what is the best way to share this information?
 - How can utilities increase literacy on this issue internally with senior managers, operators and city councils/board of directors.

Meeting 2: December 11, 2018

Municipal Wastewater Monitoring Plans for CECs

[Agenda and Summary of Municipal CECs Monitoring Plans](#)

[Meeting Capture](#)

Meeting Objectives

1. Learn about Environment and Climate Change Canada's wastewater monitoring program.
2. Advance the group's knowledge on CECs monitoring plan development and refinement.

Expert Presentation

[Monitoring Chemical Substances in Canadian Municipal Wastewater](#) was presented by guest expert Shirley Anne Smyth, the Unit Head for Wastewater Science at Environment and Climate Change Canada (ECCC). Here are some of the key takeaways from her presentation:

- Chemicals selected for ECCC's national monitoring program for municipal wastewater (over 25 sites across Canada) were based on environmental toxicity and the expectation that they would be present in larger volumes.
- Sampling is the core of a good monitoring program. The sampling method affects the results obtained and conclusions made. Key question: How do you sample a flow that is constantly changing?
- This program is delivered through the federal Chemical Management Plan (CMP), which expires in 2020. After 2020, the CMP will move beyond a chemical-by-chemical approach and look at the reality of mixtures. There are also plans to examine the cumulative effects that these mixtures may cause. Key question: How this can be done on a technical level?

- The federal government has and will continue to use the results from this program to manage chemicals through a mixture of pollution prevention and the control or ban of certain substances. The federal government uses a range of risk management and control measures, but currently provides no clear guidance to municipalities about which chemicals or substances should be monitored and managed in wastewater discharge.

Key Insights

Prior to the second meeting, CWN distributed a summary of four utility CECs wastewater monitoring plans that members of the strategic sharing group had implemented (see [Agenda](#)). The information that was summarized included: the matrix monitored (e.g. upstream surface water, effluent wastewater, etc.), monitoring frequency, monitored CECs by category (e.g. hormones, PPCPs, etc.), specific parameters monitored and the rationale for monitoring. Discussion during the meeting focused on each utility's lessons learned in developing these monitoring plans, the key information needed to get the plan approved, as well as next steps for the monitoring plan and beyond.

- One of the key challenges identified during the group's discussion was the lack of regulatory frameworks or drivers to establish municipal monitoring plans. This has led to challenges in getting senior management or city council onboard. As a result, utilities have had to engage their provincial regulator to provide guidance and support for undertaking this work.
- The drivers for the development of municipal wastewater monitoring plans vary: Of the four utility monitoring programs summarized, some were test sites for ECCC's national monitoring program for municipal wastewater, some were driven by research or partnerships with local universities, and others were prompted to undertake monitoring due to testing that occurred as part of previous or ongoing projects.
- Most of the utilities that were profiled during the discussion 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). Another key question that utilities are discussing internally is whether or not to share the results of their monitoring plans with the public and how best to communicate the results if they are shared.
- See part 3 of the [Meeting Capture](#) for a summary of each utility's discussion of their monitoring plans.

Additional Resources

[Monitoring Chemical Substances in Canadian Municipal Wastewater¹](#)

[Management strategies for trace organic chemicals in water – A review of international approaches²](#)

[Toxic potential assessment of municipal wastewater treatment plant effluents in Quebec³](#)

[Sampling for PPCPs in wastewater systems – Comparison of different sampling modes and optimization strategies⁴](#)

[Sampling for pharmaceuticals and personal care products \(PPCPs\) and illicit drugs in wastewater systems – Are your conclusions valid? A critical review⁵](#)

¹ Smyth, S. A. (2016). MONITORING CHEMICAL SUBSTANCES IN CANADIAN MUNICIPAL WASTEWATER. *Proceedings of the Water Environment Federation*, 2016(8), 5151-5163.

² Bieber, S., Snyder, S. A., Dagnino, S., Rauch-Williams, T., & Drewes, J. E. (2018). Management strategies for trace organic chemicals in water—A review of international approaches. *Chemosphere*, 195, 410-426.

³ Ministère de l'Environnement du Québec and Environment Canada. 2001. Toxic Potential Assessment of Municipal Wastewater Treatment Plant Effluents in Quebec – Final Report. St. Lawrence Vision 2000, Phase III – Industrial and Urban component. Report (136 pages) and Appendices (222 pages).

⁴ Ort, C., Lawrence, M. G., Reungoat, J., & Mueller, J. F. (2010). Sampling for PPCPs in wastewater systems: comparison of different sampling modes and optimization strategies. *Environmental science & technology*, 44(16), 6289-6296.

⁵ Ort, C., Lawrence, M. G., Rieckermann, J., & Joss, A. (2010). Sampling for pharmaceuticals and personal care products (PPCPs) and illicit drugs in wastewater systems: are your conclusions valid? A critical review. *Environmental science & technology*, 44(16), 6024-6035.

Meeting 3: February 21, 2019

Risk Management Methods beyond Monitoring Plans

[Agenda](#)

[Meeting Capture](#)

Meeting Objectives

1. Exchange knowledge on the benefits and challenges of certain risk management methods (see [Agenda](#) for roundtable discussion questions).
2. Advance the group's knowledge on a wider scope of CECs management.

Key Insights

Most participating utilities have implemented or are planning to implement a range of CECs risk management strategies. Listed below are a few examples of the strategies discussed.

- Sewer use by-laws:
 - Several utilities have implemented by-laws to regulate discharge to the municipal sanitary sewer network. However, most by-laws still focus primarily on conventional constituents instead of CECs.
- Other source control measures:
 - Some utilities are working with specific sectors (e.g. industrial customers) to help them manage their loadings. It should be noted that these management efforts may not focus specifically on CECs, but are managed passively as a co-benefit of managing other constituents.
 - Some utilities have developed a Source Water Protection Plan which helps ensure that certain CECs are monitored.
- Public communication initiatives:
 - Some utilities have undertaken (or are undertaking) public communications 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 and are increasing public awareness of these programs using mainstream media, social media campaigns, public events and paid advertising.

- Some utilities are experiencing challenges in setting targets that monitor the impacts of public communication initiatives.
- Improving internal understanding and engagement across the utility:
 - Communicating with staff about CECs is critical to obtaining buy-in from internal groups, particularly senior managers.

One of the inherent challenges that utilities are facing is a lack of internal capacity or resources for CECs programs. The absence of provincial/federal regulation is a key barrier in implementing source control measures and targeting the removal of CECs in treatment plants. Better assessing the toxicity of CECs to the environment and humans is an ongoing challenge for utilities. As these knowledge gaps are addressed, utilities can develop a case for more stringent management and/or monitoring measures. Some utilities participating in the strategic sharing group are now working toward reaching a more mature stage of CEC prioritization, where a full risk management strategy can be implemented instead of piecemeal or individual strategies.

CONFIDENTIAL

Additional Resources

[Management strategies for trace organic chemicals in water – A review of international approaches](#)⁶

[Emission of poly and perfluoroalkyl substances, UV-filters and siloxanes to air from wastewater treatment plants](#)⁷

[Environmental loadings of active pharmaceutical ingredients from manufacturing facilities in Canada](#)⁸

[The contribution of pharmaceutically active compounds from healthcare facilities to a receiving sewage treatment plant in Canada](#)⁹

[Contribution of hospital effluents to the load of pharmaceuticals in urban wastewaters: Identification of ecologically relevant pharmaceuticals](#)¹⁰

⁶ Bieber, S., Snyder, S. A., Dagnino, S., Rauch-Williams, T., & Drewes, J. E. (2018). Management strategies for trace organic chemicals in water—A review of international approaches. *Chemosphere*, 195, 410-426.

⁷ Shoeib, M., Schuster, J., Rauert, C., Su, K., Smyth, S. A., & Harner, T. (2016). Emission of poly and perfluoroalkyl substances, UV-filters and siloxanes to air from wastewater treatment plants. *Environmental Pollution*, 218, 595-604.

⁸ Kleywegt, S., Payne, M., Ng, F., & Fletcher, T. (2019). Environmental loadings of Active Pharmaceutical Ingredients from manufacturing facilities in Canada. *Science of the Total Environment*, 646, 257-264.

⁹ Kleywegt, S., Pileggi, V., Lam, Y. M., Elises, A., Puddicombe, A., Purba, G., ... & Fletcher, T. (2016). The contribution of pharmaceutically active compounds from healthcare facilities to a receiving sewage treatment plant in Canada. *Environmental Toxicology and Chemistry*, 35(4), 850-862.

¹⁰ Santos, L. H., Gros, M., Rodriguez-Mozaz, S., Delerue-Matos, C., Pena, A., Barceló, D., & Montenegro, M. C. B. (2013). Contribution of hospital effluents to the load of pharmaceuticals in urban wastewaters: identification of ecologically relevant pharmaceuticals. *Science of the Total Environment*, 461, 302-316.

Meeting 4: April 30, 2019

Internal and Public Communication Challenges and Strategies

[Agenda](#)

[Meeting Capture](#)

Meeting Objectives

1. Identify challenges associated with internal and public communication on CECs.
2. Inform and enrich the discussion on CECs communication strategies.

Expert Presentation

[Research to Practice – Own your Data, Own the Discourse](#) was presented by Lisa Ragain, Principal Water Resources Planner at the Metropolitan Washington Council of Governments. Here are some of the key takeaways from her presentation:

- For a communication strategy to be successful, there needs to be a discourse with customers (i.e., two-way communication) rather than 'education', which is typically one-way communication.
- Prior experience is a key factor that informs the public's perception of risk. As a result, it is typically very difficult for a municipal utility to bounce back from controversy.
- A key challenge in communicating with the public is that customers typically want a yes/no answer to most of their questions regarding contaminants.
- The two main elements of a strong risk communication strategy are research and practice. Research can include evidence, behavior, language and policies. Practice can include content, delivery, images and social media. More research on the way we communicate would be helpful; how we process and interpret language is key in the communication of risk. This research would also be helpful in understanding whether the ways we try to communicate risk are working and how we can improve them.
- After the implementation of any risk communication strategy, evaluation is critical.
- Internal communication within a utility is incredibly important – your staff are your best asset, as they are often on the frontlines interacting with the public.

- When communicating with the public, it is important to layer information. In other words, it is important to provide general information and then provide an additional layer for those who are interested to continue to dig deeper and learn more (e.g. through links to more specialized sources).

Lisa Ragain noted that the public wants to know if contaminants are regulated or not. Saying “we are working on it” is an excellent solution for a utility, even if there are no results to share yet because it increases transparency in the public eye. It’s important to explicitly state that a strategy or solution is in progress.

Key Insights

- One of the key challenges that many utilities have encountered is deciding if and to what degree they should share their CEC management efforts with the public. Part of this is the difficulty understanding how to package the monitoring and/or risk management efforts into a single communication strategy.
- A challenge noted by one of the utilities is convincing senior management and politicians to be transparent and inform the public of the utility’s research and risk management strategies when there is *no* crisis.
- Communication is managed by different entities and to varying degrees within each of the participating utilities. For example, some have a communication service (a separate entity from the water works department) who develop communication plans, while others have communication staff within the water department.

Additional Resources

[Sewer Use By-laws in other Jurisdictions](#)

[Blue Cities 2019 session summary: Monitoring emerging contaminants and their impacts](#)

[Risk Communication and Media Coverage of Emerging Contaminants](#)¹¹

[Analysis of Building Plumbing System Flushing Practices and Communications](#)¹²

¹¹ Ragain, L. (2009). Risk communication and media coverage of emerging contaminants. *Journal-American Water Works Association*, 101(5), 100-105.

¹² Ragain, L., Masters, S., Bartrand, T. A., Clancy, J. L., & Whelton, A. J. (2019). Analysis of building plumbing system flushing practices and communications. *Journal of water and health*, 17(2), 196-203.

Meeting 5: October 2, 2019

Using Effects-Based Monitoring and Biomonitoring to Prioritize Management Actions

[Agenda](#)

[Meeting Capture](#)

Meeting Objectives

1. Gain a basic understanding of effects-based monitoring and biomonitoring techniques and their potential role in prioritizing management actions for CECs.
2. Enrich the discussion on the use of biomonitoring as a screening approach to assess the aquatic impacts from wastewater discharge.

Expert Presentation

[Assessment of Environmental Risks Related to Emerging Contaminants in Municipal Wastewaters](#) was presented by Karen Kidd, Professor in the School of Geography and Earth Sciences & Department of Biology at McMaster University. Here are some of the key takeaways from her presentation:

- Municipal wastewater contains a mixture of CECs which can impact fish (e.g. intersex and altered gene expression). A key challenge is determining the effect of CECs on the health of fish and aquatic species and understanding if there is a cause for concern.
- 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.
- The characteristics of each WWTP and each receiving environment vary 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.

Key Insights

- Effects-based monitoring and biomonitoring are promising approaches that with ongoing research could complement standard chemical monitoring programs. Overall, 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.
- Identifying suitable reference sites will help facilitate more accurate comparative analyses of the results from effects-based/biomonitoring programs.
- There is a general lack of guidance and regulation at the provincial and federal levels. As a result, it is difficult for municipalities/utilities to justify costly effects-based monitoring and biomonitoring methods. Increased collaboration across municipalities/utilities and between multiple levels of government will help ameliorate this and initiate discussion on potential standards and guidelines.

Additional Resources

[A Screening Approach to Assess the Impacts of Municipal Wastewaters on Aquatic Systems](#)

Meeting 6: January 14, 2020

A Deeper Dive on Effects-Based Monitoring and Biomonitoring

[Agenda](#)

[Meeting Capture](#)

Meeting Objectives

1. Learn about a municipal biomonitoring program and the role of this program in informing management actions for CECs, including specific challenges and lessons learned.
2. Enrich the discussion on implementing biomonitoring programs to monitor the aquatic impacts by featuring a guest expert from Environment and Climate Change Canada's [Canadian Aquatic Biomonitoring Network](#).

Expert Presentations

[Review of the Canadian Aquatic Biomonitoring Network \(CABIN\) and Opportunities for Municipalities](#) was presented by Tim Pascoe, Environmental Scientist for Water Quality Monitoring and Surveillance at Environment and Climate Change Canada (ECCC). Here are some of the key takeaways from his presentation:

- ECCC is collaborating with partners across the country through the Canadian Aquatic Biomonitoring Network (CABIN) program to expand the coverage of and provide access to biomonitoring data, standard protocols, resources and methodologies.
- The purpose of the CABIN program is to develop a core monitoring program on a national scale that takes the “network-of-networks” approach. Some key benefits of this program include the ability make informed decisions, assess cumulative effects and effects on aquatic health, and determine cost-benefit effects.
- Where there are no existing monitoring programs, municipalities and utilities can make use of the standard protocols, resources and methodologies developed under CABIN to guide the development of their biomonitoring program and contribute to the expansion of CABIN data coverage.
- Where there are existing monitoring programs in place, municipalities and utilities can access data to further their understanding of potential downstream impacts of wastewater discharge to the aquatic community.

[Region of Waterloo Surface Water Quality Monitoring Program](#) was presented by Trevor Brown, Manager of Wastewater Operations at the Region of Waterloo. Here are some of the key takeaways from his presentation:

- The Region of Waterloo launched a surface water monitoring program in 2008. Early sampling highlighted that wastewater treatment plants and their operation had a noticeable impact on water quality in the Grand River.
- Through this program, the Region of Waterloo demonstrated that 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.
- Regular biological sampling is an effective approach for understanding and monitoring the health and composition of the aquatic system in receiving environments.

Key Insights

- Biological sampling is a key component in the effective monitoring of potential impacts from wastewater discharge on aquatic communities.
- 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 and change over time).
- Optimal sampling time is typically from late August to late October because it avoids impacts from high water and base flow. Vertebrates at this time are likely at their largest size and would ensure that mature vertebrates are being sampled, which makes taxonomic identification easier.
- There is a high likelihood that the number of commercial fee-for-service labs will increase to meet increasing biological sampling demand.
- The amount of biomonitoring data available on the CABIN website will continue to increase and the information shared will help utilities, municipalities and researchers further assess how to build effects-based monitoring programs.

Additional Resources

[Canadian Aquatic Biomonitoring Network](#)

[CABIN Certification Program](#)

[Government of Canada Open Data Network](#)

[Government of Canada Open Maps Data Viewer](#)

Meeting 7: August 5, 2020

CECs Monitoring Programs during the COVID-19 Pandemic

[Agenda](#)

[Meeting Capture](#)

Meeting Objectives

1. Discuss how utility CECs management and monitoring programs have been impacted by the COVID-19 pandemic.
2. Identify ongoing or emerging needs through structured discussion (see [Agenda](#) for discussion questions).
3. Wrap up the CEC Strategic Sharing Group and discuss how to reconnect on this topic should the need arise.

Key Insights

- Many utility CECs management and monitoring programs were either paused or delayed as a result of the COVID-19 pandemic. Some of the group's participants indicated that this was a result of focus shifting entirely to responding to the pandemic. In some cases, staff were redeployed to different departments or Emergency Operations Centres. Some municipalities with plans to launch a CECs monitoring program put these efforts on hold.
- Most of the participating utilities noted that despite provinces providing some form of regulatory relief (often on a case-by-case basis), they have not applied for regulatory relief and are still proceeding with all mandated sampling.
- The pandemic has highlighted the need for ongoing coordination with industry. Pandemic-related shutdowns of specific industrial customers resulted in impacts to wastewater treatment. The need to involve and communicate with industrial customers so that they are aware of the potentially immediate effects they may have on wastewater treatment processes is critical.
- Some municipalities have had to modify their sampling procedures to maintain physical distancing requirements and adhere to instructions mandated by the province.

Canadian Water Network's 
Canadian Municipal Water Consortium

- Securing the funding needed to either start up or continue to support CECs management and monitoring continues to be a challenge, especially given the current focus of research funding on the SARS-CoV-2 virus.
- Some utilities flagged that understanding what CECs management and monitoring programs will look like in the new normal will be critical for progress. Although partnerships with universities and other partners have been helpful in the past, shifting focus and lack of funding continue to be barriers.
- Several utilities participating in the group are now monitoring the impacts of microplastics and PFAS in wastewater; some of these utilities are collaborating with university researchers.

CONFIDENTIAL

Canadian Water Network's 
Canadian Municipal Water Consortium

Appendix 1: Strategic Sharing Group – Participating Utilities

Municipality/Utility	Participant	Position	Email Address
City of Montreal	Carole Fleury	Scientific Advisor	carole.fleury@ville.montreal.qc.ca
Utilities Kingston	Allen Lucas	Manager, Research and Projects	alucas@utilitieskingston.com
Ontario Clean Water Agency	Sangeeta Chopra	Director of Process Optimization	s Chopra@ocwa.com
	Shelly Bonte-Gelok	Director (A), Process Optimization and Technical Services	sbonte-gelok@ocwa.com
York Region	Mike Fairbanks	Manager, Water Resources, Environmental Services	mike.fairbanks@york.ca
	Mark Payne	Program Manager, Operations and Maintenance Monitoring, Environmental Services	mark.payne@york.ca
	Blythe Reiha	Program Coordinator, Water Resources	blythe.reiha@york.ca
Region of Peel	Liza Ballantyne	Manager, Water Treatment and Caledon Distribution, Public Works, Water Division	liza.ballantyne@peelregion.ca
	Kimberley Thomas	Manager, Plant Process Optimization, Wastewater Division, Public Works	kimberley.thomas@peelregion.ca
	Jeff Hennings	Manager, Water Treatment Capital	jeff.hennings@peelregion.ca
City of Calgary	Norma Ruecker	Leader Microbiology and Watershed Assessment	norma.ruecker@calgary.ca
EPCOR Edmonton	Geoff Heise	Senior Manager of Environmental Services	gheise@epcor.com

Canadian Water Network's 
Canadian Municipal Water Consortium

Municipality/Utility	Participant	Position	Email Address
Alberta Capital Region Wastewater Commission	Mike Darbyshire	General Manager	mdarbyshire@acrwc.ab.ca
	Wade Teveniuk	Regulatory Services Manager	wteveniuk@acrwc.ab.ca
Metro Vancouver	Jeff Carmichael	Division Manager, Utility Research and Innovation, Liquid Waste Services	jeff.carmichael@metrovancover.org
	Andjela Knezevic-Stevanovic	Director, Environmental Management and Quality Control, Liquid Waste Services	andjela.knezevic-stevanovic@metrovancover.org
	Lynn Landry	Program Manager Environmental Engineering, Liquid Waste Services	lynn.landry@metrovancover.org
	Laurie Ford	Program Manager, Utility Residuals Management Liquid Waste Services	laurie.ford@metrovancover.org
City of Regina	Chris Seeley	Manager, Contract and Program Development	cseeley@regina.ca
	Greg Kuntz	Manager of Environmental Services	gkuntz@regina.ca
City of Guelph	Tim Robertson	Division Manager, Wastewater Services	tim.robertson@guelph.ca