



ODWAC

Ontario Drinking Water Advisory Council

ANNUAL REPORT 2014-2015





Ontario

**Advisory Council on Drinking Water
Quality and Testing Standards**

**Le Conseil consultatif sur les normes
de qualité et d'analyse de l'eau
potable**

“Advising Ontario on Drinking Water Matters”

www.odwac.gov.on.ca

The Ontario Drinking Water Advisory Council, known formally as the Advisory Council on Drinking Water Quality and Testing Standards, is an Agency of the Government of Ontario

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1.0 Message from the Chair

On behalf of the Advisory Council on Drinking Water Quality and Testing Standards, I am pleased to present the 2014-2015 annual report outlining our activities and achievements. The Council has now completed 11 years of serving the Minister of the Environment and Climate Change, by providing independent advice focused on improving the quality and safety of drinking water in Ontario.

The Council's members, who are appointed by the Minister, all exhibit a genuine interest in protecting and improving the safety and quality of the province's drinking water. Their collective knowledge and experience facilitate the formulation of consensus-based advice and workable implementation solutions.

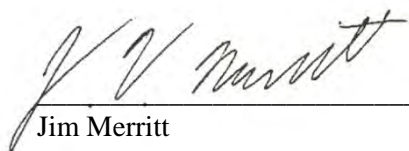
One of the most important functions of the Council is to provide the Minister with recommendations on drinking water standards. Since 2005, the Council has provided the current and previous Ministers with advice on over two dozen important drinking water quality standards. Ontario's standards have yet to be revised to reflect these recommendations, so for Ontario to continue its claim to be one of the leaders in drinking water-related public health protection, these standards must be updated.

This past year, the Council completed a comprehensive review and a set of recommendations that reflect the essence of a series of Health Canada guidance documents that address many new measures for managing microbiological risks in drinking water. There has been significant new research and technological improvements recognized by other jurisdictions in this area, such as a greater understanding of the importance of a number of pathogens and other related measures such as turbidity, as well as improvements to drinking water treatment approaches. These recent developments need to be reflected in Ontario's practices and procedures. Also, appended to this advice, the Council offered its *Report on Alternatives to Distribution System Chlorination*, aimed at providing a framework for use in guiding drinking water systems that may wish to discontinue the use of chlorine-based disinfectants in their distribution systems.

In addition, the Council provided advice on the Standards for nitrate, nitrite, *E. coli*, and total Coliforms. As well, several additional standards were reviewed for which advice has not yet been finalized.

Finally, the Council provided advice on the continued use and suggested new focus for the province's *Drinking Water Surveillance Program*, as well as on the integration of reporting health-related drinking water incidents with the *Canadian Network for Public Health Intelligence*.

As I step down as Chair, I would like to, once again, acknowledge the tireless work of the Council members, staff of the Ministry of the Environment and Climate Change, and the Ministry of Health and Long-Term Care, for their vigilance, as well as continued efforts towards the Council's mandate of providing advice on improving the quality and safety of drinking water in Ontario.



Jim Merritt

2.0 Council Background and Mandate

On May 23, 2002, Justice O'Connor, in the Part Two Report of the Walkerton Inquiry, recommended the establishment of an "Advisory Council on Standards" for drinking water, as well as making the following specific recommendations:

- Recommendation 25 states that *"In setting drinking water standards for Ontario, the Minister of the Environment [and Climate Change] should be advised by an Advisory Council on Standards."*
- Recommendation 26 states that *"The Advisory Council on Standards should have the authority to recommend that the provincial government adopt standards for contaminants that are not on the current federal-provincial agenda."*
- Recommendation 27 states that *"The Advisory Council on Standards should consider whether to replace the total coliform test with an E. coli test."*
- Recommendation 29 states that: *"The provincial government should seek the advice of the Advisory Council on Standards regarding the desirability of a turbidity limit that is lower than the limit specified in the federal-provincial Guidelines."*
- Recommendation 31: *"The Advisory Council on Standards should review Ontario's standards for disinfection by-products to take account of the risks that may be posed by the by-products of all chemical and radiation-based disinfectants."*

In recommending an Advisory Council on Standards, Justice O'Connor also noted that:

- It is reasonable to seek expertise from an Advisory Council on standards comprised of members of the broader general public; as such expertise may not reside in the Ministry of the Environment *[and Climate Change]*.
- The benefits of an Advisory Council on Standards include transparency in process and increased public participation.
- The Advisory Council on Standards should establish its own process.
- Recommendations made to the Minister of the Environment *[and Climate Change]* should be made public and should be supported by the Advisory Council on Standards' rationale.
- The Advisory Council on Standards should also advise the Minister of the Environment *[and Climate Change]* with respect to management, treatment, testing, materials, and reporting standards.

On May 12, 2004, The Minister of the Environment [*and Climate Change*] announced the establishment of the Ontario Drinking Water Advisory Council (Council), known formally as the “Advisory Council on Drinking-Water Quality and Testing Standards” in the *Safe Drinking Water Act, 2002*.

Enabled under Section 4 of the *Safe Drinking Water Act, 2002*, the Council is “*to consider issues relating to standards for drinking-water quality and testing and to make recommendations to the Minister*” of the Environment [*and Climate Change*], which are to be “*taken into consideration in establishing and revising standards under this Act for drinking-water quality and testing.*” (See *Appendix F for the relevant sections of the Safe Drinking Water Act, 2002*)

The Minister of the Environment and Climate Change appointed members from key professional fields representing a cross-section of academia, industry and municipalities, with expertise in the areas of microbiology, toxicology, risk assessment, engineering, utility operations, public health, and others with a record of interest and accomplishment related to drinking water. They are all active in their areas of knowledge and bring their current and direct experience to the Council’s deliberations. (See *Appendix G for the Council Members’ Biographies*)

The broad mandate of the Council is to provide advice and make recommendations to the Minister of the Environment and Climate Change on drinking water quality and testing standards, as well as other drinking water matters deemed appropriate to merit the attention of the Minister of the Environment and Climate Change, and the Ministry of the Environment and Climate Change.

3.0 Summary of Activities and Accomplishments

Following is a summary of the Council's activities and accomplishments from May, 2014 to May, 2015:

3.1 Requests from the Minister of the Environment and Climate Change

The Minister of the Environment and Climate Change can formally request that the Council provide direct advice and make recommendations on drinking water policies, practices, procedures, standards, testing methods, and related research.

The following requests were referred to the Council by the Minister in previous years:

1. Drinking-Water Systems Regulation (Ontario Regulation 170/03) Review of smaller, private system requirements (2005)
[*\(See full report here\)*](#)
2. Wells Regulation (Ontario Regulation 903) Disinfection Requirements (2005)
[*\(See advice letter here\)*](#)
3. Corrosion Control / Lead Reduction (2007)
[*\(See first advice letter here in 2006-2007 Annual Report\)*](#)
[*\(See second advice letter here in 2007-2008 Annual Report\)*](#)
4. Tritium Standard (2009)
[*\(See full report here\)*](#)
5. USEPA's Initiatives to Regulate Contaminants as Groups; as well as Perchlorate and Hexavalent Chromium (2011)
[*\(See advice letter here\)*](#) *(Request still in progress)*

3.2 Standards Review

Part of the Council's mandate is to provide advice to the Minister of the Environment and Climate Change on proposed drinking water standards, objectives, and guidelines and their applicability in Ontario. Recommendation 25 of the *Part Two Report of the Walkerton Inquiry*, states that "*In setting drinking water standards for Ontario, the Minister of the Environment should be advised by an Advisory Council on Standards*".

In order to provide comprehensive advice, the Council assesses Health Canada's Guideline Technical Documents, comments from the national and Ontario public consultation processes, and information on the occurrence and impact that a particular substance is likely to have on the delivery of safe drinking water in the province.

Based on this assessment, the Council may recommend the endorsement of a Canadian Drinking Water Quality Guideline (CDWQG) as an Ontario Drinking Water Quality Standard (ODWQS) in Ontario Regulation 169/03, or as an Objective, or Guideline, or it may make an alternative recommendation. When appropriate, the Council may also conduct independent consultations with stakeholders and technical experts as deemed necessary to formulate its advice.

Standards Reviews Completed:

- *E. coli* / Total Coliforms (*See Appendix D*)
- Nitrate / Nitrite (and Ammonia) (*See Appendix E*)

Standards Currently Under Review:

The following standards are still under review by the Council. Presentations were received and discussions took place on Health Canada's Documents for Public Comment and / or Guideline Technical Documents. The Council will continue to assess these contaminants and will provide formal advice to the Minister of the Environment and Climate Change in an appropriate and timely fashion, if warranted. The Standards include:

- 1,2-Dichloroethane
- Selenium
- Toluene, Ethylbenzene, and Xylenes (TEX)
- Tetrachloroethylene
- pH
- Guidance on the Use of the Microbiological Drinking Water Quality Guidelines
- Guidance for Issuing and Rescinding Boil Water Advisories in Canadian Drinking Water Supplies

The Council also discussed other drinking water contaminants and related substances, but did not formally review them.

Standards Prioritization:

Part of the Council's mandate is to provide advice and make recommendations on matters relating to the prioritization of the review and development of standards for drinking water quality in Ontario.

In addition, the *Part Two Report of the Walkerton Inquiry* noted in Recommendation 26, that *"The Advisory Council on Standards should have the authority to recommend that the provincial government adopt standards for contaminants that are not on the current federal-provincial agenda."*

Specifically, in establishing its own process, the Council has chosen to review, on a yearly basis, the list of priority substances as developed by the Federal-Provincial-Territorial (FPT) Committee on Drinking Water (CDW).

The purpose of this review is to recommend the addition of substances for Ontario to put forward, that may not be on the current National Priority List, and / or to recommend the bumping-up of existing substances as deemed important for the province. For the May, 2014 to May, 2015 Council year, a review was completed and the Council concurred with the National Priority List.

3.3 Council Initiatives:

While the Minister of the Environment and Climate Change can request that the Council provide advice on specific matters related to drinking water, the Council can also choose to engage in drinking water matters, which it has identified as being of interest, and which, in its opinion, may merit the attention of the Minister of the Environment and Climate Change, and the Ministry of the Environment and Climate Change.

The process by which the Council engages in its initiatives is as follows:

- Initiatives are identified through the Council's priority-setting process.
- The Council decides whether or not to form a working group to facilitate tasks, based on the complexity of the initiative.
- The Council or working group then decides how to best approach each initiative using any or all of the following means, including:
 - inviting a Ministry of the Environment and Climate Change expert make a presentation to the Council
 - inviting an external expert make a presentation to the Council
 - carrying out a literature search
 - holding a stakeholder and / or experts workshop and / or symposium
 - facilitating a research project
- The conclusions and suggested recommendations are deliberated by the full Council, and advice is developed and transmitted to the Minister of the Environment and Climate Change, in cases where it is deemed to merit some attention and / or action.

Even though advice may have already been transmitted in some cases, many of these initiatives are of an on-going nature. As such, the Council remains engaged from the perspective of reviewing the development of legislative, regulatory and policy amendments, in order to provide on-going advice to the Minister of the Environment. Following is a brief outline of the initiatives that the Council was engaged in from May, 2014 to May, 2015:

Initiatives Completed:

Advice on Health Canada's Microbiological Safety of Drinking Water Guidance as related to the Procedure for Disinfection of Drinking Water in Ontario.

The Council was made aware that the Ministry of the Environment and Climate Change is in the process of revising the "*Procedure for Disinfection of Drinking Water in Ontario*" (Procedure).

The Council has taken great interest in this next revision to the Procedure due to the importance of its operational-level application, and the convergence of many treatment-based standards and other pertinent guidance.

To this end, the Council has formally reviewed all of Health Canada's guidance documentation, related to the microbiological safety of drinking water as well as other treatment-related substances, including:

- Enteric Viruses
- Enteric Protozoa
- Heterotrophic Plate Counts
- Waterborne Bacterial Pathogens
- Guidance on the Use of the Microbiological Drinking Water Quality Guidelines
- Chlorine
- Turbidity

The purpose of the review was to advise the Minister of the Environment and Climate Change the applicability and appropriateness of the guidance for use here in Ontario, as related to the Procedure. (*See Appendix A*)

Advice on Alternatives to Distribution System Chlorination

The Council had become aware that some jurisdictions other than Ontario have quite different approaches to both primary and secondary disinfection (the practice of maintaining a *chlorine* residual in the distribution system). In some other jurisdictions, much less reliance is placed on chemical disinfection, and particularly in the use of chlorine, than is the case in Ontario.

Given its role of providing advice to the Minister of the Environment, it was considered desirable for the Council to become better informed on this matter. To this end, the Council held a symposium on September 22, 2008, to hear from experts in many other jurisdictions.

An ensuing expert panel session was held on September 23, 2008, comprised of the experts and several Council members, with the goal of developing possible recommendations for the province so that it may be in a position to consider a process to allow for alternative approaches to disinfection, particularly for distributed water.

The Council continued completed its research on alternative approaches to drinking water disinfection and appended its report, entitled “*Report on Alternatives to Distribution System Chlorination*”, to the Advice on Health Canada’s Microbiological Safety of Drinking Water Guidance as related to Ontario’s Disinfection Procedure, above.

(See Appendix A)

Advice on the Ministry of the Environment and Climate Change’s Drinking Water Surveillance Program (DWSP)

The Council met with the Ministry of the Environment and Climate Change’s Drinking Water Surveillance Program (DWSP) to offer advice on a possible future direction and scope for the program, as it undergoes a review, resulting in an advice letter being sent to the Minister of the Environment and Climate Change. (See Appendix B)

Advice on Ontario’s Adoption of the Canadian Network for Public Health Intelligence (CNPHI)

The Council had been observing the shortcomings and lack of integration of the province’s current systems for reporting and tracking Drinking Water Advisories for several years now. To this end, the Council wrote the Minister of the Environment and Climate Change to encourage the use of the Canadian Network for Public Health Intelligence (CNPHI) for entering and tracking all Drinking Water Advisories. (See Appendix C)

Initiatives in Progress / Areas of Ongoing Interest:

The Council can engage in its own initiatives / areas of ongoing interest with a view towards providing advice to the Minister of the Environment and Climate Change, if deemed appropriate, in the future. Following is a list of topics discussed over this annual report year:

- Accreditation of Drinking Water Systems
 - Alternative Disinfectants
 - Backflow and Cross-Connections
 - Bill S-8 Federal Safe Drinking Water for First Nations Act
 - Blood Lead Level reports (Health Canada)
 - Blue-Green Algae Blooms
 - Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health (COA)
 - Canada-U.S. Great Lakes Water Quality Agreement
 - Canadian Network for Public Health Intelligence (CNPHI)
 - Climate Change
 - Cryptosporidium, Giardia Monitoring
 - Distribution System Risk and Practices
 - Drinking Water Advisories and Reporting System (DWARS)
-

- Drinking Water Quality Management Standard (DWQMS)
- Drinking Water Research Initiatives in Ontario
- Drinking Water Systems (Regulation 170) Monitoring Parameters Review
- Drinking Water Systems Inspection Process and Licence Content
- E. coli Field Test Kits
- Endocrine Disruptors / Pharmaceuticals and Personal Care Products
- First Nations Drinking Water Quality and Federal Bill S-8
- Hydraulic Fracturing
- Hydrogen Peroxide as a Disinfectant
- Lead in Drinking Water (Schools and Nurseries)
- Micro / Nano Plastics
- Microcystin Field Test Kits
- MOHLTC Small Drinking Water Systems
- Nano Plastics
- NMYRR Systems and Designated Facilities Inspections and Compliance
- Ontario's Great Lakes Strategy and the Great Lakes Protection Act
- Operator Training, Certification, and Curriculum
- Source Protection Planning Process
- Statutory Standard of Care
- WaterTAP
- Wells Regulation (Regulation 903)

3.4 Stakeholder / General Public Consultations:

The Council may publish information on the Environmental Registry and undertake additional consultations on standards, regulations, or other drinking water matters, to solicit views from stakeholders or the general public, in order to provide advice and recommendations to the Minister of the Environment and Climate Change.

Both the Drinking-Water Systems Regulation (Ontario Regulation 170/03) Review of smaller, private system requirements (2005), and the Tritium Standard Review (2009), underwent full stakeholder / general public consultations. (*See Section 3.1 above*)

3.5 Administrative

Memorandum of Understanding

On July 7, 2010, the Chair of the Council and the Minister of the Environment both signed a Memorandum of Understanding (MOU), replacing the Terms of Reference from November 5, 2004. This MOU was re-affirmed on May 31, 2012, by the current Minister of the Environment and Climate Change.

The MOU clearly outlines the roles and responsibilities of both the Council and the Ministry of the Environment and Climate Change, and reaffirms the importance of working together to ensure Ontario remains a leader in drinking water protection, through an up-to-date and transparent standards-setting process, involving increased public input.

Learning and Development Map

The use of Learning and Development Maps is promoted government-wide for Agencies, Boards, and Commissions. To this end, the Council continued to update its Learning and Development Map.

The purpose of the Learning and Development Map is to:

- promote a learning culture and continuous improvement;
- identify key learning and development needs and opportunities for members and staff (*Identification of the key learning and development needs are via the Council's "all things drinking water" mandate and core activities such as: Requests from the Minister of the Environment and Climate Change; Standards Review; and Council Initiatives*)
- identify individual members' excellence in certain areas and promote the sharing of skills;
- coordinate learning and development in an efficient and structured fashion;
- promote and protect the Council's reputation and credibility leading to public confidence; and
- promote the Council's presence and profile leading to industry awareness.

The Learning and Development Map has been and will continue to be carried out via:

- listing key conferences / courses / presentations to Council and cross-referencing with member / staff learning and development needs;
- seeking financial support for those members where a key learning / development need has been identified, an opportunity exists, and the member has no financial support from their employer or industry association;
- seeking financial support for staff where a key learning / development need has been identified and an opportunity exists;
- ideally having at least 1 attendee at each key conference / training course;
- considering allocation of limited resources; and
- providing written reports back to the Council.

Appendix A - Advice on Health Canada's Microbiological Safety of Drinking Water Guidance as related to Ontario's Disinfection Procedure

40 St. Clair Avenue West
7th Floor
Toronto, Ontario
M4V 1M2

Tel 416.212.7779
Fax 416.314.9237

40, avenue St. Clair ouest
7^e étage
Toronto, Ontario
M4V 1M2

Tél 416.212.7779
Télé 416.314.9237



July 9, 2014

The Honourable Glen Murray
Minister of the Environment and Climate Change
77 Wellesley Street West
11th Floor, Ferguson Block
Toronto, Ontario M7A 2T5

Dear Minister Murray:

Re: Advice on Health Canada Guidelines and Guidance on the Microbiological Safety of Drinking Water and Other Substances as they relate to the *Procedure for Disinfection of Drinking Water in Ontario*

Health Canada regularly reviews its Guidance for microbiological parameters related to the delivery of safe drinking water, in order to determine if there has been enough new research to warrant any updates or revisions. To this end, Health Canada has completed new guidance documents for the following microbiological and microbiologically-related topics, all of which are intended to assist owners, operators, municipalities and provinces by providing them with the best practices for delivering safe drinking water to consumers:

- Enteric Viruses
 - Enteric Protozoa
 - Turbidity
 - Heterotrophic Plate Counts
 - Waterborne Bacterial Pathogens
 - Use of the Microbiological Drinking Water Guidelines
 - Ammonia
 - Chlorine
-

Your Council has carefully reviewed all these documents (*See Appendix C for complete list*) with a view to identifying topics and new and improved practices that should be considered and included in Ontario's Drinking Water Safety Net. In fact, the Council has already had input into the development of Health Canada's final guidelines and guidance documentation through Ontario's participation on the Health Canada's Federal / Provincial / Territorial Committee on Drinking Water (CDW).

As a result of our review, we have identified a number of new concepts and practices that should now be adopted so that Ontario can continue to maintain its leadership role in drinking water safety. This advice letter makes a number of recommendations largely derived from the national guidance documents. Ontario does not currently have a process to access and adopt the national guidance documents that are a product of the CDW, as the contents of these microbiologically-related documents are focused on good practices and procedures and, as such, they do not lead directly to numerical drinking water standards.

In addition to our review of the national guidance documents, it should be noted that the 2002 Part Two Report of the Walkerton Inquiry made recommendations, which now apply to the Procedure and which tasked this Council, either directly or indirectly, with addressing the following:

- Recommendation 27: *“The Advisory Council on Standards should consider whether to replace the total coliform test with an E.coli test.*
- Recommendation 28: *“No formal maximum contaminant level for protozoa should be established until real-time tests are available. The objective, as with bacteriological and viral pathogens, should be zero, and the regulations should so state; but the standard should be a treatment standard, specified in terms of log removal dependent on source water quality.”*
- Recommendation 29: *“The provincial government should seek the advice of the Advisory Council on Standards regarding the desirability of a turbidity limit that is lower than the limit specified in the federal-provincial Guidelines.”*
- Recommendation 31: *“The Advisory Council on Standards should review Ontario's standards for disinfection by-products to take account of the risks that may be posed by the by-products of all chemical and radiation-based disinfectants.”*

In 2003, the Ministry of the Environment (MOE) first released the **“Procedure for Disinfection of Drinking water in Ontario”** (Procedure), in response to the relatively new *Safe Drinking Water Act, 2002* and its related regulations. The Procedure endeavored to provide guidance to designers and operators of drinking water systems with respect to disinfecting drinking water. It was also referenced in Regulation 170/03, the Drinking Water Systems Regulation, and was revised again in 2006.

Over the past 9 years, this Council has provided the Ministers of the Environment with letters of advice on several matters related to the disinfection of drinking water, ministry regulations, the 2006 version of the Procedure, and the above-noted Walkerton Recommendations, including:

- 2005 advice on bacteriological Standards and monitoring in response to Walkerton Recommendation # 27.
- 2005 advice with respect to the Procedure and the Walkerton Recommendations. Although the Council had some concerns at that time, it concluded that an updated Procedure was an important step forward and it needed to be released to the drinking water community as quickly as possible, provided the Council be afforded the opportunity for a more thorough review prior to future revisions.
- Advice on several disinfection by-products, per Walkerton Recommendation #31. This recommendation is of an on-going nature; therefore, the Council will continue to provide advice, to the Minister of the Environment, on pertinent disinfection by-products, in a timely fashion. *(See Appendix C for complete list)*
- This Council has not previously provided advice on Walkerton recommendation #28 regarding Protozoa. The Council has, however, been monitoring the progress made by Health Canada, as well as research activities and approaches of other jurisdictions. This letter now reflects our conclusions on this topic.

Advice with regard to E. coli and total coliforms, which reflects more recent developments in science and changes made by Health Canada and other jurisdictions, will be forthcoming. These changes should also be incorporated into the Procedure or appropriate ministry regulations or guidance documentation.

It is now time to move forward with updates relating to Walkerton Recommendations #28, #29, and #31, as outlined by Justice O'Connor in his Part Two Report, and on the premise of new and improved research and risk assessment developments.

The Council has concluded that the Procedure, as well as appropriate ministry regulations / guidance documentation, is the appropriate place to apply the new and updated national practices and our recommendations. In addition, the Procedure needs to be revised so that new technological advances and new research findings over the past 10 years can be incorporated.

The Council recommends that the Procedure for Disinfection of Drinking water in Ontario, as well as appropriate ministry regulations / guidance documentation be revised to include the recommendations outlined in this advice letter and to recognize and promote the use of updated practices in Ontario.

Various ministry regulations and guidance documents, including the Procedure deal with many of the topics in Health Canada's guidance documents noted above, but there is new and updated information within these documents which will enhance the delivery of safe drinking water. The Council, in reviewing Health Canada's guidance documents, has identified a series of comments, conclusions and recommendations, relating to them that should be applied within Ontario's drinking water framework. As well, the Council has noted additional comments, conclusions, and recommendations that are not necessarily addressed by Health Canada's guidance. The following comments and Recommendations reflect the Council's conclusions and overall advice to you.

Application of the Procedure:

The current version of the Procedure does not clearly identify the target audience. In addition, it lacks an overview of what the province's expectations are regarding the operational practices of owners and operators. The current Legislation and Regulations set out the legal framework but do not provide guidance on how drinking water systems should actually be operated to remove or inactivate pathogens in order to provide microbiologically safe drinking water.

The revised Procedure should be targeted to owners and operators responsible for system operations, but should also provide assistance or advice to Ministry of the Environment drinking water inspections staff.

The Council recommends that the Procedure for Disinfection of Drinking Water in Ontario should include an introductory section identifying the target audiences and the principles behind the provision of microbiologically safe drinking water, through the use of monitoring tools and good operational practices. Many of these principles can be found in Health Canada's new guidance documents.

Removal / Inactivation of Pathogens Practices:

Ontario's current practices utilize a system of "Log Reduction" requirements and credits to derive minimum levels of treatment. The current tables in the Procedure should be revised to be consistent with those in Health Canada's guidance.

The Council Recommends that the Procedure for Disinfection of Drinking Water in Ontario be revised to be consistent with Health Canada guidance on Enteric Viruses, Enteric Protozoa, and Waterborne Bacterial Pathogens. (See Appendix A)

(Additional recommendations specifically related to Enteric Viruses, Enteric Protozoa, and Waterborne Bacterial Pathogens and turbidity are included in Appendix A.)

Source Water Monitoring:

In addition to the comprehensive advice in Health Canada's guidance documents on Enteric Viruses and Enteric Protozoa, the Council identified several specific changes which should be made to Ontario's current practices. Several jurisdictions have already introduced regulatory source water monitoring for enteric protozoa (e.g. *Cryptosporidium*, *Giardia*) to determine the level of source water risk and the appropriate level of treatment required.

As a leader in drinking water practices, the province should introduce such microbiological monitoring of source water at surface water and GUDI systems, through the Drinking Water Surveillance Program (DWSP), and consider requirements for the larger surface water and GUDI drinking water systems in the province, thereby demonstrating a leadership role and at the same time building laboratory capacity.

In addition, Health Canada's recent "Guidance on the Use of the Microbiological Drinking Water Quality Guidelines" recommends that source water monitoring should include *E. coli*, *Cryptosporidium*, *Giardia*, and turbidity.

The Council also recommends that monitoring for *Cryptosporidium* and *Giardia* should be initiated at the province's larger surface water and GUDI drinking water systems, and, as well, through the Drinking Water Surveillance Program.

Other Waterborne Bacterial Pathogens:

Regulation 170, Schedule 16-3 currently identifies a list of bacteria that trigger Adverse Water Quality Incidents if found in drinking water test results (e.g. *Pseudomonas aeruginosa*, *Staphylococcus aureus*, *Clostridium* spp., fecal *streptococci*). This list should be reviewed for relevance and could possibly be removed or replaced with other organisms consistent with Health Canada's updated guidance on Waterborne Bacterial Pathogens.

The Council further recommends that Section 16-3 of Regulation 170 should be revised to reflect current research on the selection of meaningful waterborne bacterial pathogens.

Turbidity:

Health Canada's new guidance document on turbidity reflects a significant change in the importance of turbidity as a direct and important indicator of effective drinking water treatment. Turbidity is an indicator of the presence of particles in water, which can have a direct bearing on the microbiological safety of the water produced.

In the past, turbidity has been viewed by operators as just an aesthetic parameter (i.e., affecting the acceptability of the water by consumers). In practice, a plant operator has only two real time indicators of the quality of water leaving a drinking water treatment system; namely turbidity and chlorine residual. Results for microbiological water quality indicators only become available long after the water has left the treatment plant and in the distribution systems or is at the tap of the consumer. The revised Procedure should reflect the importance of turbidity as an indicator for monitoring health-based treatment limits as described in Health Canada's new guidance document on turbidity.

In addition, the Council has concluded that, for Ontario, all drinking water treatment systems should be able to meet a treatment limit of 0.3 NTU, for individual filters effluents, regardless of the type of filter technology. This would, however, require an amendment to Regulation 170, and an exceedance event would therefore trigger an Adverse Water Quality Incident including corrective actions.

Of importance is to note that Health Canada actually recommends a treated water turbidity target of 0.1 NTU for individual filters effluents, regardless of the type of filter technology, based on the "As Low As Reasonably Achievable" (ALARA) Principle.

In addition, Health Canada recommends that there should be an operational target of 1.0 NTU for finished water leaving a treatment plant and entering the distribution system.

The Council recommends that the Procedure for Disinfection of Drinking Water in Ontario be revised to be consistent with Health Canada's guidance on Turbidity and that Regulation 170 be amended to set a new limit for surface water and GUDI drinking water treatment systems of 0.3 NTU for all individual filter effluents, regardless of technology, which direct water to the next stage of treatment.

(Additional recommendations specifically related to turbidity are included in Appendix A.)

Municipal Drinking Water Licence Renewal (5 Year):

Ontario's current Legislation requires that each municipal residential drinking water system have a license to operate that system in addition to a permit to build or alter the system. The operating license needs to be renewed every five years. In light of the recommendations in this advice letter, the Council concluded that the five year renewal would provide an ideal opportunity for each municipal residential drinking water system to reassess its capability of providing microbiologically safe drinking water, and to confirm that the original design conditions are still applicable. Source water quality may change over time, so experience can be gained by tracking trends as a result of land use and climatic changes, as well as operational response to events.

The five year review is also an ideal opportunity to analyze the turbidity, chlorine residual and microbiological data collected over those years to identify trends and potentials for higher risk events that may indicate deterioration of water quality.

As well, operational procedures may have changed. The Procedure and Regulation 170 both set out minimum overall log reduction and treatment requirements. In the past, many drinking water systems have used the minimum as their actual practice and goal, rather than re-characterizing the source water quality and adequacy of treatment barriers in place.

As part of the five year review, drinking water system owners and operators should be encouraged to use new assessment tools such as Quantitative Microbiological Risk Assessment (QMRA) to improve the effectiveness of their current treatment practices, through microbiological monitoring of source water.

It should be noted that the licence renewal process required every 5 years now includes Appendix C: Raw Water Assessment for the Renewal of the Municipal Drinking Water Licence, which encourages the waterworks owner to re-evaluate the source water conditions and confirm the adequacy of treatment barriers in place.

The Council recommends that, as part of the five-year Municipal Drinking Water Licence Renewal requirement, owners and operators undertake a reassessment of the capability of their treatment system to meet at least the minimum overall log reduction requirements, based on the quality of their source water, using an assessment tool such as QMRA.

The Ministry of the Environment has recognized the importance of continuous improvement through the optimization of treatment processes, and has developed 2 guidance documents for use by drinking water systems: "Strategies for Minimizing the Disinfection By-Products Trihalomethanes and Haloacetic Acids" and "Optimization Guidance Manual for Drinking Water Systems". These documents should also be referenced or linked to the Procedure.

As well, the Ministry of the Environment's "Design Guidelines for Drinking-Water Systems" is a guidance document with a target audience of system designers and Ministry of the Environment staff engaged in the approval of drinking water treatment systems. This document should also be referenced or linked to the Procedure.

(More specific recommendations regarding the five-year Municipal Drinking Water Licence Renewal are included in appendix A.)

Alternatives to Distribution System Chlorination

In 2008, the Council undertook an independent review of the use of chlorine-based disinfectants as the most common form of disinfection in use in Ontario. The purpose of the review was to better understand disinfection practices of other international jurisdictions and particularly the use of chlorine-based disinfectants to maintain a disinfectant residual in the distribution systems of municipalities. The Council has heard public concerns about the use of chlorine-based disinfectants in drinking water and is aware that some drinking water systems and other jurisdictions have discontinued their use. *The report of this review is attached to this letter as appendix B.*

The Council concluded that chlorine-based disinfectants are currently the only means of maintaining a distinct, measureable disinfectant residual in distribution systems. If, however, a community wants to use an alternative, the Council has established an approach to assist the Director in approving such a different approach. Regulation 170 allows the Director, or in some cases a licenced engineering practitioner, to approve alternative approaches.

The Council recommends that chlorine-based disinfectants continue to be the only method of maintaining a disinfectant residual in municipal distribution systems. In considering an application for an alternative approach, the Director / licenced engineering practitioner should follow the processes set out in the Council's report found in appendix B.

Operator Training:

Once revisions to the Procedure are finalized, it should be noted that the course content and training manuals for operator certification and continuing education should also change to remain up-to-date with the new information, which will guide them in the improved operation of their Drinking Water System.

The Council recommends that Operator certification and continuing education course content and training manuals be updated to reflect a revised Procedure for Disinfection of Drinking Water in Ontario, as well as, where appropriate, revised ministry regulations or new guidance documentation.

Conclusion:

With the finalization of Health Canada's new guidance documentation, appropriate ministry regulations, guidance documents, and the Procedure for Disinfection of Drinking Water in Ontario need to be updated to ensure that the province maintains its leadership role by providing current science-based guidance and oversight. As well, the Procedure itself can be updated periodically without regulatory change, which means it can remain more current with leading edge research and practices.

The Council feels that these recommendations, based on Health Canada's microbiological and microbiologically-related guidelines and guidance, in relation to the Procedure, will help to strengthen the practices within the province, leading to safer drinking water for Ontarians.

Sincerely,

Original Signed By Jim Merritt

Jim Merritt, Chair
Ontario Drinking Water Advisory Council

Attachments:

Appendix A: *List of Disinfection Procedure and Microbiologically-related Recommendations*

Appendix B: *Report on Alternatives to Distribution System Chlorination*

Appendix C: *List of Health Canada Guideline / Guidance Documents and Other Pertinent Documents*

Appendix A:

List of Disinfection Procedure and Microbiologically-Related Recommendations

Regarding advice on revised Health Canada guidelines and guidance related to the microbiological safety of drinking water and other substances as they may relate to the *Procedure for Disinfection of Drinking Water in Ontario* and other appropriate ministry regulations or guidance documentation.

General Disinfection Procedure Recommendations:

- Revise the Procedure for Disinfection of Drinking Water in Ontario, or other appropriate ministry regulations or guidance documentation, to include Health Canada's guidance as part of the practices of this province.
- Provide guidance to the Director (or licenced engineering practitioner), via the Procedure, when considering other water treatment processes which are equivalent to or better than the status quo (secondary disinfection using chlorine-based disinfectants) - See Appendix B.
- Develop an "Application" Section, which endeavours to explain the purpose of the Procedure in relation to its intended audience(s) (i.e. owner / operators / inspectors).

Health Canada Guideline and Guidance Document Related Recommendations:

Microbiological Indicators:

***E. coli* / Total Coliforms:**

- The Council is in the process of developing and transmitting separate advice on *E. coli* and total coliforms to the Minister of the Environment, as these microbiological contaminants have numerical Standards as found in Schedule 1 of Reg. 169 (*Ontario Drinking Water Quality Standards*).

Heterotrophic Plate Counts:

- Recognize Heterotrophic Plate Counts (HPC) as an important operational parameter and incorporate Health Canada's Guidance into a revised Procedure or other appropriate ministry regulations or guidance documentation, where possible.
- Provide guidance for operators when investigating HPC results outside of the normal range. Unusual results can provide indications of stagnation, tuberculation, inadequate residual disinfectant, or availability of nutrients for bacterial regrowth.

Enteric Viruses / Enteric Protozoa / Waterborne Bacterial Pathogens / Guidance on the Use of Microbiological Drinking Water Quality Guidelines:

- Develop a "microbial" DWSP to aid in the collection of characterization of source water data for analysis of levels and trends (*i.e. Cryptosporidium, Giardia, viruses, Campylobacter, E. coli, etc.*).
- Review and update the bacteria listed in Section 16-3. (1) 2. of Reg. 170 in order to validate their appropriateness.
- Make Virus and Protozoa log reduction practices consistent with those of Health Canada's (*See page 39 of Health Canada's Guideline Technical Document on Enteric Viruses and pages 45 and 47 of Health Canada's Guideline Technical Document on Enteric Protozoa*).

Turbidity:

- Provide a more fulsome description of the types of filtration in the Disinfection Procedure, or other guidance documentation, where warranted.
- Develop a preamble on the importance of turbidity: How it is related to health risk and how to manage and reduce it.
- Provide guidance for achieving a Treatment Target of 0.1 NTU for all individual filter effluents directing water to the next stage of the treatment process (regardless of the filter technology).
- Set a Treatment Limit of 0.3 NTU for all individual filter effluents directing water to the next stage of the treatment process (regardless of the filter technology). Exceedance of this limit would trigger an Adverse Water Quality Incident (AWQI).
- Provide guidance for operators to carry out trend monitoring in order to detect operational problems with filter effectiveness, finished water and distribution system turbidities (*e.g. in the case of upward trending, even though operational limits and / or targets have not been exceeded*).
- Set an Operational Target of 1.0 NTU for finished water and distribution system water.
- Provide guidance for operators to initiative an assessment, if the Operational Target of 1.0 NTU cannot consistently be met, to determine the cause of the turbidity and to determine "appropriate" finished water turbidity for the system, taking into account the ALARA Principle to support secondary chlorination effectiveness.

Drinking Water Treatment Additives:

Chlorine, Ammonia:

- Recognize and incorporate into a revised Procedure or other appropriate ministry regulations or guidance documentation, where possible, Health Canada's Guidance on Chlorine and Ammonia, due to their importance in the drinking water treatment processes, and the possibility of Disinfection By-Product formation as a result of their addition.
- Establish rationales for the recommended target residual levels for chlorine / chloramine residuals, in the distribution system, of 0.20 mg/L and 1.0 mg/L respectively.
- Explain implications of chlorine residuals exceeding recommended maximum concentrations (e.g. 4 mg/L free chlorine).

Disinfection By-Products:

- Recognize and reference, into a revised Procedure or other appropriate ministry regulations or guidance documentation, where possible, Health Canada's Guidance and Guidelines on disinfection by-products, due to their possible formation as the result of the various disinfection processes utilized in the province. There are key Health Canada documents for THMs, Chlorite / Chlorate, HAAs, Chloral Hydrate, and NDMA, among others.
- Continue to implement the ministry's "Strategies for Minimizing The Disinfection By-Products Trihalomethanes and Haloacetic Acids" guidance document. The Council recognizes that considerable progress has been made on reducing Disinfection By-Products in many systems through the implementation of this manual.

Regarding Advice on Other Topics as they may relate to the *Procedure for Disinfection of Drinking Water in Ontario or the Microbiological Safety of Drinking Water*

Five-Year Municipal Drinking Water Licence Renewal Recommendations:

- Consider QMRA an important tool and a best management practice within the multi-barrier approach to safe drinking water; but it need not be a requirement of the Procedure.
- Link QMRA or similar approach to the 5 year review of source water quality to demonstrate that treatment barriers continue to be suitable.
- Amend Regulation 248 to allow for additional monitoring of source water in Reg. 248 outside of the licenced laboratory regime (*i.e. should not be regarded as regulatory testing*).

- Use the Source Protection Planning process to help inform the 5 year review.
- Reassess / demonstrate site-specific log reduction credits every 5 years, and link them to the DWQMS, Licence renewal, and Permit review, in order to determine / demonstrate appropriate overall log reduction requirements for each system.

Trends Recommendations:

- Provide guidance to operators for monitoring turbidity, disinfectant residual, pressure, and pH trends in real-time throughout the treatment process.
- Provide guidance to operators and encourage comprehensive distribution system trend monitoring for turbidity, chlorine residual, and pressure.
- Provide guidance to operators and encourage water treatment plants operators to monitor trends and make corrective actions before limits are reached (i.e. turbidity, Total Coliforms, and perhaps Heterotrophic Plate Counts).
- Include source water events and abnormal conditions (i.e. storms, seasonal changes, fire-fighting events) in guidance documentation for monitoring system trends.
- Link trend monitoring results to the Five-Year Municipal Drinking Water Licence Renewal process.

Alternatives to Distribution System Chlorination Recommendations:

- The Ministry of the Environment should provide internal guidance, via the Procedure, to the Director (or Licenced Engineering Practitioner) for the exercising of discretion under Schedules 1 and 2 of Regulation 170, when considering alternatives to distribution system chlorination, per the report found in Appendix B.
- The Director (or Licenced Engineering Practitioner) should require the proponent to undertake a site-specific risk assessment as part of their application for the use of an alternative to distribution system chlorination.
- The Director (or Licenced Engineering Practitioner) should require the proponent to obtain the endorsement of the local Medical Officer of Health prior to any request or application for the use of an alternative to distribution system chlorination.

Appendix B: Report on Alternatives to Distribution System Chlorination

Introduction

On June 30, 2004, the Council had been asked by the Minister of the Environment to review the Drinking Water Systems Regulation under the *Safe Drinking Water Act* (Regulation 170/03) specifically with respect to its application to small and rural water systems. The concern was that that requirement under this regulation were be too onerous for small and private water systems and that there may be alternative regulatory approaches available. The Council conducted a province-wide public consultation. As a result, the Council recommended that a more flexible approach be taken without sacrificing public protection. A “site-specific risk based” approach was recommended to be administered by local health units. Through this review, the Council heard several concerns about the use of chlorine both for primary water treatment and secondary disinfection in water distributions systems. The Council also heard that many communities in Europe have discontinued the use of chlorine due to aesthetic concerns and possible disinfection by-product formation. As such, chlorine has been replaced with alternative approaches to ensure safe drinking water in other jurisdictions.

Subsequent to the Council’s review of Regulation 170, the Council undertook reviews of the drinking water Standards for Trihalomethanes (THMs) and Haloacetic Acids (HAAs). These contaminants largely originate from the use of chlorine as a disinfectant. Elevated levels of both THMs and HAAs are deemed to be indicators of long-term health concerns. At the same time the Council reviewed Health Canada’s Guidance Document on Chlorine. As a result of these reviews and concerns raised about the benefits and risks of chlorine use, the Council decided to undertake an independent review of the use of chlorine with a focus on alternative disinfection practices used in other jurisdictions and the ramifications to the water distribution system.

It is important to distinguish between primary disinfection and secondary chlorination of the distribution system.

Primary disinfection is a unit process which, along with other treatment processes, removes and / or inactivates pathogens from the source water such that the finished water leaving a water treatment plant is microbiologically safe for drinking. This process is well understood and many methods, including the use chlorine, have been proven effective.

Secondary disinfection is a process targeted at protecting the distribution system, specifically with respect to microbial quality. In Ontario’s Drinking-Water Systems Regulation (Regulation 170) the term “secondary disinfection” means the maintenance of a chlorine or chloramine residual, in the finished water, as well as throughout the entire distribution system. Any other form of secondary disinfection requires Director’s approval.

As such, the Council decided to focus this report on alternative methods to distribution system chlorination.

Background

The Ontario Drinking Water Advisory Council was established under Section 4 of Ontario's *Safe Drinking Water Act, 2003* and its role and establishment was a key recommendation of the Walkerton Inquiry Commission. The role of the Council is to independently provide recommendations on drinking water matters that the Council has become aware of and has identified as being of interest and which may merit the attention of the Ontario Minister of the Environment, and the Ontario Ministry of the Environment.

Symposium

The Council's approach to the review of alternative disinfection strategies began with a review of the current research and literature with a focus on the practices in other countries and jurisdictions.

A working group of Council members was established to coordinate and guide the review. It was agreed that the best approach to understanding what others were doing was to invite key representatives to make presentations. To this end, a symposium was held on September 22, 2008, which was open to people across Ontario who were active in the provision of drinking water services. Approximately 60 people attended. International speakers gave presentations on various aspects of disinfection and related risks and the practices of various countries. Ontario's current Legislative and Regulatory framework was also presented. A list of speakers and their topics is as follows:

Topic	Presenter
<i>"A Brief Review of Some Key Disinfection Concepts"</i>	Dr. Robert Andrews , Professor, University of Toronto
<i>"Regulatory Framework for Disinfection of Drinking Water in Ontario"</i>	Pat Lachmaniuk , Ontario Ministry of the Environment
<i>"Assessing Distribution System Integrity: The Case for Maintaining a Disinfectant Residual"</i>	Dr. Mark LeChevallier , American Water
<i>"Implementing Safe Drinking Water in Australia"</i>	Mary Drikas , Australian Water Quality Centre
<i>"A Risk Context for Assessing Disinfection"</i>	Dr. Steve Hruday , Professor, University of Alberta
<i>"Disinfection Practices and Regulations in Norway"</i>	Dr. Hallvard Ødegaard , Professor, Norwegian University of Science and Technology
<i>"The Dutch Secret: Safe Drinking Water Without Chlorine in The Netherlands"</i>	Dr. Hans van Dijk , Professor, Delft University of Technology

The attendees were encouraged to ask questions and enter into discussions on the various topics. The presentations of the symposium are available on the Council's website at:

Ultimately, the Council wanted to consider if there were circumstances where alternative approaches to distribution system chlorination might be allowed in Ontario, where water is supplied to 6 or more connections.

Workshop

On September 23, 2008, the Council met with the international presenters and discussed their approaches and ideas in greater detail in a workshop format. The objective was to see if there were concepts or practices that could be applied in the Ontario context. This report summarizes the workshop and the subsequent deliberation of the Council and observations, conclusions and recommendations.

The first half of the workshop provided an opportunity for the Council members to ask questions of the international experts, with the added benefit of already hearing their presentations and the questions and discussions generated by the other symposium attendees.

The second half of the workshop was devoted to identifying issues and solutions that would need to be taken into consideration if a drinking water system was to consider an alternative to distribution system chlorination. *(A summary of the workshop notes is provided in Appendix A)*

The experts present were: Dr. Steve Hrudehy, Dr. Mark LeChevallier, Mary Drikas, Dr. Hallvard Ødegaard, Dr. Daniel Urfer, Dr. Hans van Dijk, and Dr. William Anderson.

The Council Members present were: Dr. Robert Andrews, Dr. Peter Huck, Derrick Kamanga, Dr. Ken Roberts, John Rudnickas, Dr. Mary Jane Conboy, Jim Merritt, Dr. Lesbia Smith, Dr. Robert Lannigan, Rob Walton, and Dr. Alex Hukowich.

The Ministry / Council support staff present were: Pat Lachmaniuk, MOE and Scott Barrett, ODWAC.

The overall concern was the safety of water provided to the public, and the discussions were organized, using the five elements of the multi-barrier approach to safe drinking water, as well as management aspects:

- Source
- Treatment
- Distribution
- Monitoring
- Response

During the Council's review, it became apparent to the working group that the focus was shifting from the whole treatment regime towards the distribution system or the secondary chlorination component, and it became clear that the general public was concerned about the aesthetic and disinfection by-product aspects of chlorine in their tap water.

Therefore, the outstanding questions appear to be:

- Are there other measures that could potentially offer the same overall level of public health protection as is attributed to maintaining a chlorine residual within the distribution system?
- Does distribution system chlorination, in fact, provide the level of continued protection from microbiological contamination that is generally attributed to it?
- How can the risks with respect to the formation of THMs, HAAs and other possible disinfection by-products be appropriately considered?
- How could the risks of microbiological contamination be balanced with the health risks of the disinfection by-products?

At the end of the workshop, the attendees developed a list of the “pros” of maintaining a chlorine residual in the distribution system versus the “cons” of discontinuing this practice:

Pros:

- Status Quo for the most part
- History of public health protection
- Indicator of intrusion (negative pressure)
- Main break repairs / pipe and equipment installations are performed hygienically (with chlorine)
- Can be measured on-line
- Easily available
- Knowledge of chlorine and application systems
- Low cost
- Ability to maintain and boost
- Biofilm control
- Ability to maintain a chlorine residual in large building “distribution systems”

Cons:

- Water treatment plant upgrades might be necessary
- Might need infrastructure shift to smaller, higher pressure pipes, no loops, no dead ends, new material (PVC), etc.
- Firefighting storage could be an issue
- Reduced “self-cleaning” of pipes
- Water main and sewer main separation distances could be an issue
- Complexity of regulatory framework and possible amendments
- Risk of distribution system integrity detection
- Treated water must be biostable
- Paradigm shift (Philosophical change)

Other points were raised, which were pertinent to the discussion, regarding negative aspects of secondary chlorination, were as follows:

- Taste and odour concerns
- Disinfection By-Product formation
- No real sound science on effective or optimal chlorine residual concentration
- Chlorine may not be the best disinfectant (i.e. not effective against *Cryptosporidium*)
- There are potential alternatives to chlorine (silver, copper, peroxide, UV booster stations, etc.)

Following the workshop the Council’s working group collected additional reference material to aid in further deliberation. Subsequent to the symposium, Health Canada has finalized or has been developing several Guideline Technical Documents and Guidance Documents on drinking water protection, which had a direct bearing on the Council’s deliberations. These included:

- A Guideline for *E. Coli*
- A Guideline for Total Coliforms
- Guidance on Heterotrophic Plate Counts
- A Guideline for Enteric Viruses
- A Guideline for Enteric Protozoa
- Guidance on Waterborne Bacterial Pathogens
- Guidance on the Use of Microbiological Water Quality Guidelines
- Guidance on Chlorine
- Guidance on Ammonia
- Guidance on Turbidity
- A Guideline for HAAs
- A Guideline for THMs
- A Guideline for NDMA
- A Guideline for Chlorite / Chlorate
- A Guideline for Chloral Hydrate

These documents represented a significant resource in aiding the Council's discussions and enabling the formulation of conclusions.

Observations

(a) Ontario - Ministry of the Environment

In Ontario, Regulation 170 requires that a chlorine residual be maintained after water leaves a water treatment plant, as well as throughout the entire distribution system. Sections 1-5 and 2-5 of the Regulation state the requirements:

Schedule 1: Treatment equipment (*municipal residential*):

Secondary disinfection

1-5. The owner of a drinking water system shall ensure provision of,

- (a) water treatment equipment that is designed to be capable of secondary disinfection using chlorination or chloramination in accordance with the Ministry's *Procedure for Disinfection of Drinking Water in Ontario* and that is designed to be capable of achieving, at all locations within the distribution system,
 - (i) a free chlorine residual of 0.2 milligrams per litre, if the drinking water system provides chlorination and does not provide chloramination, or
 - (ii) a combined chlorine residual of 1.0 milligrams per litre, if the drinking water system provides chloramination; or
- (b) other water treatment equipment that, in the Director's opinion, is designed to be capable of providing secondary disinfection that is equivalent to or better than the secondary disinfection provided by the equipment described in clause (a).

Schedule 2: Treatment equipment (*municipal non-residential; non-municipal residential; non-municipal non-residential*):

Secondary disinfection

2-5. (1) The owner of a drinking water system shall ensure provision of,

- (a) water treatment equipment that is designed to be capable of secondary disinfection using chlorination or chloramination in accordance with the Ministry's *Procedure for Disinfection of Drinking Water in Ontario* and that is designed to be capable of achieving, at all locations within the distribution system,
 - (i) a free chlorine residual of 0.2 milligrams per litre, if the drinking water system provides chlorination and does not provide chloramination, or
 - (ii) a combined chlorine residual of 1.0 milligrams per litre, if the drinking water system provides chloramination; or
- (b) other water treatment equipment that, in the opinion of a professional engineer, is designed to be capable of providing secondary disinfection that is equivalent to or better than the secondary disinfection provided by the equipment described in clause (a).

These sections apply to systems with distribution systems that primarily provide water to residences (Distribution System is defined under the *Safe Drinking Water Act, 2002* as "part of a drinking-water system that is used in the distribution, storage or supply of water and that is not part of a treatment system". This excludes "plumbing".)

There is, however, the potential for an alternative approach to be considered under subsection 1.5(b) where the Director is of the opinion that other treatment equipment is capable of providing equivalent or better secondary disinfection.

Such Director discretion is rarely exercised in Ontario due largely to the lack of guidance or a framework to support such a decision. Subsection 2.5(b) also provides for such discretion on the part of a professional engineer. The Ministry of the Environment (MOE) has, in the past, provided direction or guidance to the Director to support such discretion in other environmental areas. They have also prepared a guideline for the permit to take water program that provides a framework for the Director to review and approve Permits To Take Water.

(b) Ontario - Ministry of Health and Long-Term Care

The local Medical Officer of Health also plays an important role in Ontario. Under the *Health Protection and Promotion Act* (HPPA), a local Medical Officer of Health may take actions to provide the necessary assurances that consumers have been notified of adverse water quality and may also provide instructions to users or owners and operators of drinking water systems on how to mitigate the risk and ensure that the owners and operators of the affected drinking water system is taking necessary corrective actions.

The Ministry of Health and Long-Term Care uses both a “Drinking Water Protocol” and a “Response to Adverse Drinking Water Quality Incidents” guidance document to support boards of health in responding to adverse drinking water quality incidents. This framework could be expanded to include support for decision-making for alternative approaches to disinfection scenarios.

In practice, any consideration of a municipal system wishing to discontinue the practice of secondary chlorination would have to be accepted or endorsed by the local Medical Officer of Health.

The Ministry of Health and Long-Term Care also has oversight of small drinking water systems (SDWS) in Ontario through Ontario Regulation 319/08 (Small Drinking Water Systems). These businesses or premises make drinking water available to the public via private systems.

These systems are already subject to a site-specific assessment approach; as such they may not be required to practise distribution system chlorination and many do not have distribution systems in the classical sense.

(c) Classes of Drinking Water Systems

There are three classes of drinking water systems that are most relevant to the Council's considerations on alternatives to chlorination:

1. Municipal Residential – All of these systems practice distribution system chlorination.
2. Non-municipal Year-round Residential – These systems have distribution systems and are required to practise distribution system disinfection.
3. Designated Facilities – If these systems have distribution systems, they are required to practise distribution system disinfection.

The Ministry of the Environment conducts proactive, risk-based inspections at Non-Municipal Year-Round Residential systems and systems serving Designated Facilities and has identified areas that are challenging from a compliance perspective. One such area is the maintenance of chlorine residual in the distribution system where it is required.

In addition, there are a number of private systems that serve water to the public, which are regulated by the Ministry of Health and Long-Term Care (MOHLTC) under their Small Drinking Water Systems Regulation 319. Some of these systems have distribution systems but may not chlorinate.

(d) Council's Observations

Arising from the symposium, the workshop and subsequent reviews and deliberations of the working group, the Council made the following observations:

- Concerns have been expressed by some groups and members of the public regarding the presence of chlorine in their drinking water, as related to odour and taste. As a result, some have changed to bottled water.
- Water treatment plant operators have access to a limited number of real-time measures to monitor drinking water quality in the distribution system; namely: turbidity, chlorine residual, and pressure. Although chlorine is a disinfectant, the residual is also an important indicator of changes in the distribution system and can alert the operator to possible microbial contamination. Bacterial testing does not provide immediate information. If the use of a chlorine residual is discontinued, then which other indicator could replace it that would provide real-time information to the operator? It should be noted, however, that in practice real-time monitoring of chlorine residuals in distribution systems may not be available at enough locations to provide an immediate indication of a problem.

- The Dutch Experience: The Netherlands do not permit the use of chlorine in their water treatment practices (other than distribution system disinfection during repairs or main breaks). This decision was initially based on the concern for disinfection by-products such as THMs and HAAs but was later supported by the public due to aesthetic considerations. In addition, they have a high rate of public acceptance of drinking water. Their alternative approach is complex (see symposium notes and presentation) but entails advanced treatment to remove organic carbon (food source for bacterial regrowth), UV light disinfection, higher water pressures and the redesigning of their distribution systems to reduce resident time of water in the system. To apply this approach in Ontario would require significant infrastructure changes.
- Other Jurisdictions: Most other jurisdictions require the use of chlorine for secondary disinfection; however some provide flexibility to consider other approaches and, in practice, permit such alternatives. A number of European cities no longer use chlorine in their treatment and distribution systems, or use it at much lower levels than in North American practice, and also apply a more risk-based approach for their smaller systems. British Columbia does not require the use of chlorine by regulation; the method of disinfection is addressed through their approval process.
- Chlorine may only be effective in killing or inactivating bacteria and viruses. As well, systems that rely solely on chlorine as the treatment barrier will not be able to effectively inactivate the enteric protozoan *Cryptosporidium*. The disinfection potential of chlorine within the distribution system has also been questioned in some research literature. It is important to distinguish between primary disinfection and secondary chlorination of the distribution system. Primary disinfection at the treatment plant is well understood and many methods, including the use chlorine, have been proven effective.
- Many smaller non municipal systems in Ontario do not use chlorine. They rely on alternatives such as membrane filtration or UV light for disinfection.
- Large buildings (offices, apartments and condominiums) have extensive distribution systems contained within the building. The rules for maintaining a chlorine residual apply only at the property line. The Ontario Building Code governs the water system within such buildings and is usually only applied at the time of construction or major renovations.
- The Ministry of the Environment's (MOE) *Procedure for Disinfection of Drinking Water in Ontario* provides guidance to designers of water systems, the owners and operators of water systems and MOE staff. It is referenced in Regulation 170 and sets out specific requirements and criteria including the appropriate levels of chlorine residual maintenance in a distribution system.
- 'Secondary disinfection' with a chlorine residual is required for ground water sources that are free from *E. coli* or total coliform and that are not required to provide other treatment measures. This is presumably to protect the water from recontamination in the distribution system.

- Products and materials that come into contact with drinking water must be certified to the appropriate NSF standards:
 - NSF standard 60 addresses the health effects that can be caused by treatment chemicals as well as impurities associated with them. Some of the products covered by this standard include corrosion and scale control chemicals, pH adjustment, softening, precipitation, and sequestering chemicals, coagulation and flocculation chemicals, well-drilling products, disinfection and oxidation chemicals, and other miscellaneous and specialty chemicals for the treatment of drinking water.
 - NSF standard 61 addresses the health effects caused by additives, products and materials that originate from processed media, mechanical devices, and mechanical plumbing devices, such as faucets and valves. This standard considers whether contaminants that leech or migrate from the product / material into the drinking water could be at concentrations that are potentially harmful to human health.
 - Products certified to NSF standard 60 or 61 relate only to performance issues with impurities that may impact human health.

Risks and Concerns

Distribution system chlorination represents a balance of risk to public health. The maintenance of a chlorine residual in distribution systems has traditionally been used to minimize immediate or acute public exposure to microbiological contamination. On the other hand, chlorine and other chemical additives may result in elevated levels of disinfection by-products, which may increase overall long-term chronic health risks. So, it is difficult for the general public to have sufficient information to understand and balance the risks. One of the presenters (Steve Hrudey - *"A Risk Context for Assessing Disinfection"*) reviewed the risk issues and methods for evaluating and comparing relative risks.

Considerations

The primary questions considered by the Council were whether Ontario's current distribution system chlorination practices need to be amended and whether there are cases or circumstances where distribution system chlorination may not be necessary, and if, this is the case, what alternative, if any, could be used.

The public concern seems to centre on taste and odour objections and perceived health issues regarding chlorine itself. The Council has reviewed the standards for various disinfection by-products and has recommended new standards that are protective of public health (See www.odwac.gov.on.ca). If a community wanted to consider a non-chlorination approach, then it would need to demonstrate that protection of public health would be at least as protective as the current treatment regime.

The Council also looked at the matter from the perspective of the decision makers, such as an MOE Director or a local Medical Officer of Health, and specifically focused on what questions would they require answers to in order to make an informed decision and exercise their due diligence. The suggested questions are as follows:

- What problem is an applicant trying to solve by discontinuing chlorination?
- Is the discontinuation of chlorine the best means of dealing with the problem?
- Is there evidence that chlorine is the cause of the problem?
- Is the proposed alternative approach at least as protective of public health? (Risk Assessment)
- Does the alternative approach have any long or short-term health effects (i.e. are there any unintended consequences)?
- How is the effectiveness of the alternative approach measured (i.e. confirmatory testing)?
- How would the system be risked-managed to ensure it is as protective as a chlorinated system?

Conclusions

In reaching its conclusions, the Council took into account the following:

- chlorine-based disinfectants are currently the only means of maintaining a disinfectant residual in distribution systems
- It is not simple for an operating authority to change to a new system
- Treatment regimes from other jurisdictions may not be easily transportable into Ontario
- The provincial government maintains responsibility for safe drinking water in Ontario
- For decades, chlorination has been proven effective for primary disinfection to protect the public from microbial contamination of public water supplies (with the exception of the protozoan pathogen *Cryptosporidium*).
- Secondary chlorination has been used for decades as well, but its utility and efficacy has been in question
- The basis for the levels of secondary chlorination in Ontario is not well understood

In considering exceptions or alternative approaches, the various classes of systems should be addressed differently;

- Municipal Residential Systems
- Non-Municipal Year-Round Residential Systems (private)
- Designated facilities
- Private Systems that serve the public (administered by MOHLTC)

Municipal Residential Systems

Distribution system chlorination should continue to be the best practice in Ontario.

If a community wants to consider non-chlorine based approaches then they should:

- conduct a full risk-based assessment including:
 - o identifying the problem or concern
 - o providing evidence that chlorination is the cause of the problem
 - o undertaking a risk comparison of the proposed alternative approach(es)
 - o satisfying that there are no long or short-term health effects as a result of using the alternative (i.e. unintended consequences)
 - o proving that a “disinfectant residual” can be maintained and measured
 - o identifying how risks will be managed
- obtaining endorsement of the local MOH
- applying for an exemption under the *Safe Drinking Water Act, 2003* and Regulation 170

Non-Municipal Year-Round Residential Systems (private)

Some of these systems may not currently provide distribution system chlorination (or even primary chlorination). Chlorination may present its own risks and problems for owners of such small private systems, due to the sometimes complex nature of chlorinating a water supply.

Some of these systems may have only limited distribution systems that serve only a few residences. They may have short or limited distributions systems with ground water sources. They may already have installed and operate a relatively advanced membrane filtration and UV light system.

The MOE could take a more flexible approach for this class of systems by implementing a “Site-Specific Risk Based Assessment” model, such as allowing the use of Point of Entry (POE) systems.

Designated Facilities

The same points and conclusions apply as noted above for Non-municipal Year-Round Residential Systems.

Private Systems that serve the public (administered by MOHLTC)

Oversight for Ontario's private systems that serve the public was transferred from the Ministry of the Environment to the Ministry of Health and Long-Term Care in 2008. As such, local public health units have been tasked with implementing a risk-based approach for regulating these types of small drinking water systems in Ontario.

Recommendations

- The Ministry of the Environment should provide guidance to the Director and professional engineer for exercising of discretion under schedule 1 and 2 of Regulation 170. This guidance could be provided in a revised version of the "*Procedure for Disinfection of Drinking Water in Ontario*".
- A site-specific risk assessment should be undertaken as part of a proponent's application for the use of an alternative to distribution system chlorination.
- The endorsement of the local Medical Officer of Health should be sought prior to any request or application for the use of an alternative to distribution system chlorination.

Appendix A – Workshop Notes

These notes relate to the identification of potential solutions for issues which might be present should a drinking water system want to consider an alternative to distribution system chlorination.

Multi-Barrier Approach Categories:

Source

- Use well-qualified staff to conduct and assess source studies
- Employ a QMRA model for risk assumptions
- Select best source for quality and sustainability
- Distinguish between Groundwater / GUDI / Surface Water
- Confirm source water quality via monitoring
- Establish source water protection zones (25-50 year)
- Have ability to shut down in-takes (with back-up supply / storage availability)
- Encourage manufacturers to produce less hazardous or biodegradable materials

Treatment

- Remember that primary disinfection / inactivation of pathogens is key and paramount
- Achieve biostability as overall goal
- Treat appropriately for water characteristics
- Treat water as a food product (philosophical change)
- Keep AOC low (<10 µg/L) (biofiltration)
- Develop AOC (Assimilable Organic Carbon) / BDOC (Biodegradable Organic Carbon) as operational parameters if practical
- Specify biofiltration in the absence of AOC data
- Keep TOC low for distribution system biofilm control (less chlorine needed then)
- Use real-time turbidity
- Remove particles / pathogens
- Remember that distribution system chlorination is not effective for *Cryptosporidium* inactivation
- Remove ammonia (and potentially methane, sulfur, iron and manganese)
- Keep NOM low (enhanced coagulation)
- Use well-qualified staff
- Consider UV as an important disinfection component
- Consider corrosion control
- Start with groundwater; add nano-filtration and UV
- Consider chlorine disinfectant alternatives (i.e. silver, copper, idoine, bromide, hydrogen peroxide, UV booster stations, etc.)
- Consider decentralized treatment (POE / POU)

Distribution

- Assess integrity using physical, hydraulic, and water quality properties
- Institute a cross-connection control program (focusing on larger commercial users)
- Manage main breaks (hygienic working conditions when repairing or installing pipes / equipment; flushing / disinfection procedures)
- Use small diameter pipes and higher high flow rates
- Keep leakage low (assess pipe conditions and improve detection)
- Carefully select new pipe material (PVC and copper better?; use certified materials and products)
- Reduce detention time in distribution system (No loops; just branched networks)
- Manage storage tank water age issues
- Watch sewer line separation distances from drinking water lines
- Upgrade sewer lines (material, wall thickness) if close to drinking water lines
- Use backflow-sensing water meters
- Reduce power outages (have backup systems)
- Use surge control tanks and vacuum release valves
- Use elevated tanks / reservoirs (more robust than pump-based systems)
- Employ filters on ventilation systems at reservoirs
- Increase monitoring in distribution systems
- Consider UV “booster stations” in distribution system
- Consider chloramine to be a weaker disinfectant than chlorine
- Consider maintaining secondary chlorination and remove it at the tap (POU device for chlorine removal)
- Self-cleaning network
- Maintain flushing and other cleaning measures
- Keep system pressurized
- Eliminate dead-ends
- Eliminate low flow zones
- Introduce modeling in designs
- Watch proximity to septic fields (subsoil treatment systems) / tanks

Monitoring

- Monitor source to confirm water quality and establish trends
- Monitor treatment processes
- Monitor distribution system for pressure, chemical, and microbial parameters (*E. coli*, Total Coliforms, Heterotrophic Plate Count, pathogens)

Response

- Institute water safety plans
- Manage alarms
- Adopt taste and odour requirements (re public acceptance)
- Determine point of system ownership (property line versus tap)

Management

- Determine and formalize ownership
- Obtain community declaration of recognition or acknowledgement of risk (burden of proof rests with proponent)
- Obtain consumer buy-in (financial commitment) for full cost for water, construction, upgrades, management, and liability (ensure there is a rider for waterborne outbreak)
- Institute water quality management plan
- Integrate smaller systems into large more efficient systems

Appendix C: List of Health Canada Guideline / Guidance Documents and Other Pertinent Items

New advice to be incorporated into a revised Procedure with regard to:

- Health Canada Guideline Technical Document on Enteric Viruses; 2011*
- Health Canada Guideline Technical Document on Enteric Protozoa; 2012*
- Health Canada Guidance on Waterborne Bacterial Pathogens; 2013*
- Health Canada Guidance on the Use Heterotrophic Plate Counts in Canadian Drinking Water Supplies; 2012*
- Health Canada Guidance on the Use of the Microbiological Drinking Water Quality Guidelines; 2013*
- Health Canada Guideline Technical Document on Turbidity: 2012*
- Health Canada Guidance on Ammonia
(*Finalized but not posted on Health Canada's website as of yet*)
- Health Canada Guidance on Chlorine; 2009*

* These and other drinking water-related guideline/guidance documents published by Health Canada can be found at:

http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php#tech_doc

Previous Advice Letters sent to the Minister of the Environment with regard to:

- Recommendations on the “*Procedure for Disinfection of Drinking Water in Ontario*”; 2005
- Health Canada Guideline Technical Document on Trihalomethanes; 2005
- Health Canada Guideline Technical Document on Chlorite and Chlorate; 2007
- Health Canada Guideline Technical Document on Haloacetic Acids; 2008
- Health Canada Guidance on Chloral Hydrate; 2008
- Health Canada Guideline Technical Document on *N*-Nitrosodimethylamine (NDMA); 2012

Appendix B - Advice on Ontario's Drinking Water Surveillance Program

40 St. Clair Avenue West
7th Floor
Toronto, Ontario
M4V 1M2

Tel 416.212.7779
Fax 416.314.9237

40, avenue St. Clair ouest
7^e étage
Toronto, Ontario
M4V 1M2

Tél 416.212.7779
Télé 416.314.9237



Ontario

Advisory Council on Drinking Water
Quality and Testing Standards

Le Conseil consultatif sur les normes
de qualité et d'analyse de l'eau
potable

July 22, 2014

The Honourable Glen Murray, Minister
Ministry of the Environment and Climate Change
77 Wellesley Street West
11th Floor, Ferguson Block
Toronto, Ontario M7A 2T5

Dear Minister Murray:

**Re: Advice on the Ministry of the Environment's
Drinking Water Surveillance Program (DWSP)**

Part of the Ontario Drinking Water Advisory Council's mandate is to provide you with advice on drinking water matters that the Council has become aware of and has identified as being of interest and which may merit your attention.

To this end, the Council understands that the Drinking Water Surveillance Program (DWSP) is under review and we would like to take this opportunity to provide you with our thoughts on the program with a view to improving its strength and utility.

The DWSP has been an important foundation of information on the quality of drinking water in the province for many years now. It is a resource of data and trends on many potential chemical contaminants which are not otherwise monitored by municipalities.

The DWSP has been an important source of information to facilitate the monitoring and assessment of trends for both source and treated water at participating drinking water systems. Furthermore, some drinking water systems, relying on groundwater for their source, only require monitoring every 3 or 5 years under Regulation 170/03. Participation in the DWSP would provide these systems with useful data for assessing any changes in water quality or system performance on an annual basis. Also, the ministry benefits from the data as it represents water quality trends over two or more decades on a province-wide basis.

This Council makes extensive use of the data available from the DWSP in deliberating on drinking water issues and recommending Ontario Drinking Water Quality Standards to you and your ministry. These recommendations are often formulated to address Ontario-specific needs and realities. In many cases, the information gleaned from DWSP is not available through any other means.

As well, the DWSP results are used extensively by both provincial and federal governments (Health Canada), and also by researchers and academia for many projects funded by Ontario's Showcasing Water Innovation (SWI) program. One goal of this program is to demonstrate leading edge, innovative and cost-effective solutions for managing drinking water, complementing Ontario's *Water Opportunities Act* by fostering innovation and creating opportunities for economic development.

The DWSP relies on municipal participation to collect and submit samples for analysis and management by the ministry. However, municipal participation has been declining over the years due to regulatory concerns and additional workload.

The DWSP could become an even more useful and more widely-accepted tool for all involved, including the participating municipalities, if the sample results obtained could also be used to fulfill some of the regulatory monitoring requirements of the Drinking Water System. Currently, regulatory barriers do not allow the DWSP results to qualify for regulatory purposes, resulting in a duplication of time and costs.

In addition, the Council envisions a shift in drinking water monitoring which could be facilitated by re-focusing the DWSP priorities on contaminants of emerging concern. The Council, in the near future, will be providing extensive advice to you on the microbiological safety of drinking water and other practices as they relate to the "Procedure for Disinfection of Drinking Water in Ontario". One key element in this advice is the growing trend towards characterizing source water on a regular basis, in order to verify necessary pathogen log reduction needs on a site-specific basis.

In particular, other jurisdictions, such as the United States Environmental Protection Agency (USEPA), and other Canadian provinces now require that larger municipalities monitor for *Cryptosporidium* / *Giardia* in their source water as a means of determining site-specific reduction requirements for enteric protozoa. Ontario currently does not have the laboratory capability or capacity to perform *Cryptosporidium* / *Giardia* testing, nor is it in a position to require municipalities to monitor for such.

The Council believes that *Cryptosporidium* / *Giardia* monitoring should be initiated by the DWSP at Ontario's larger surface water treatment plants, thereby building analytical capacity and demonstrating leadership. Monitoring for *Cryptosporidium* / *Giardia* in source water also offers beneficial links to the Source Protection Planning process and the 5-Year Municipal Drinking Water System Licence Renewal process.

In summary, the Council feels that the Drinking Water Surveillance Program supports continuous improvement in the quality of drinking water for Ontarians and is an essential component of Ontario's Drinking Water Safety Net.

Sincerely,

Original Signed by Jim Merritt

Jim Merritt, Chair
Ontario Drinking Water Advisory Council

Appendix C – Advice on Ontario’s Integration with the Canadian Network for Public Health Intelligence

40 St. Clair Avenue West
7th Floor
Toronto, Ontario
M4V 1M2

Tel 416.212.7779
Fax 416.314.9237

40, avenue St. Clair ouest
7^e étage
Toronto, Ontario
M4V 1M2

Tél 416.212.7779
Télééc 416.314.9237



September 30, 2014

The Honourable Glen Murray, Minister
Ministry of the Environment and Climate Change
77 Wellesley Street West
11th Floor, Ferguson Block
Toronto, Ontario M7A 2T5

Dear Minister Murray:

**Re: Advice on Ontario’s Adoption of the
Canadian Network for Public Health Intelligence (CNPHI)**

The broad mandate of the Ontario Drinking Water Advisory Council is to provide advice to you and make recommendations on drinking water quality and testing standards, as well as other drinking water matters, which the Council feels merit your attention.

To this end, the Council has been observing the shortcomings and lack of integration with the province’s current systems for reporting and tracking Drinking Water Advisories for several years now. As you may be aware, for drinking water systems under Regulation 170, the issuing and rescinding of drinking water advisories is a shared responsibility with the Ministry of Health and Long-term Care. The Ministry of Health and Long-Term Care has responsibility over all other drinking water systems in the province.

Concurrent to this observation, the Council has also been aware for many years now, of the work of the Canadian Network for Public Health Intelligence (CNPHI) relating to drinking water advisories and has been updated on enhancements to the program on a regular basis.

CNPHI is a secure web-based group of applications designed for public health officials to facilitate the real-time collection and processing of laboratory and epidemiological surveillance data, dissemination of strategic intelligence, and coordination of public health response.

CNPHI supports data sharing and collaboration by integrating disparate data sources and facilitating intelligence generation and dissemination to enhance public health coordination and response activities at local, regional, provincial/territorial and national stakeholders. Its use eliminates cross-reporting and duplication of efforts where multiple agencies/departments are involved within a jurisdiction. In addition, the jurisdiction remains the owner of the data and retains control over the level of information that is shared outside the secure site (i.e., automatic updating of agency websites).

CNPHI has a specific Drinking Water Advisories application, and its users are supported over time by the established CNPHI team at the Public Health Agency of Canada, and the system is available at no cost to agencies. The CNPHI platform integrates and interfaces with existing provincial/territories databases and as such does not require the adoption or replacing of systems currently used.

CNPHI has distinct advantages over all of Ontario's other Drinking Water Advisories systems in that it is capable of real-time notification within and across jurisdictions when advisories are issued, updated or rescinded. This kind of information and notification is an invaluable tool for reporting and notifying stakeholders and the public in a timely manner. Analytical and reporting tools also help to characterize water quality and the operational reasons behind the Drinking Water Advisories, and the trends that may indicate deteriorating conditions. In addition, the tool has a system registry to manage various levels of information regarding individual drinking water systems (i.e., contact information during emergencies) and generate automated custom reports based on user requirements. Currently in development within the module are tools to manage routine monitoring data (accommodating direct lab interface) of microbiological, physical/chemical and radiological data.

As well, *all* of Ontario's Public Health Units already use various CNPHI public health alerting modules for reporting on health-related issues and are familiar with the system. Registered users of the system would be able to access the Drinking Water Advisories module with their existing accounts. CNPHI currently has public health alert modules for respiratory, enteric, zoonotic, adverse immunological reactions and sexually transmitted/blood borne infection. They also have access to surveillance-related modules for physician data, hospital data, animal health data, and environmental/public health data. There is synergy between all the modules as they are complementary in nature (e.g., drinking water advisories and enteric alerts).

Provinces which already use or are preparing to use CNPHI for Drinking Water Advisories are: Saskatchewan (Health and Environment), Manitoba (Health and Environment), Yukon Territories and North West Territories, New Brunswick, Alberta, and Nova Scotia, as well as several Health Canada First Nations Inuit Health Branch Regions. It should be noted that the Ontario FNIHB regional offices will be adopting the system within a few months.

The Council recommends that Ontario adopt the use of the Canadian Network for Public Health Intelligence (CNPHI) for entering and tracking all Drinking Water Advisories.

The Council believes that adoption of the Canadian Network for Public Health Intelligence (CNPHI) for entering and tracking all Drinking Water Advisories will serve to protect, support and promote the safety of the quality of drinking water for Ontarians, without any increased regulatory burden. In fact, efficiency of notification, easier status tracking (which can be readily shared among responsible authorities), and the facilitation of the tracking of trends could actually reduce regulatory burden by foreseeing problems which could result in a future Drinking Water Advisory, if not managed in a timely fashion.

Sincerely,

Original Signed by Jim Merritt

Jim Merritt, Chair
Ontario Drinking Water Advisory Council

Appendix D - Advice on Ontario's *E. coli* and Total Coliform Standards and Monitoring

40 St. Clair Avenue West
7th Floor
Toronto, Ontario
M4V 1M2

Tel 416.212.7779
Fax 416.314.9237

40, avenue St. Clair ouest
7^e étage
Toronto, Ontario
M4V 1M2

Tél 416.212.7779
Télé 416.314.9237



December 9, 2014

The Honourable Glen Murray
Minister of the Environment and Climate Change
77 Wellesley Street West
11th Floor, Ferguson Block
Toronto, Ontario
M7A 2T5

Dear Minister Murray:

Re: Advice on the Ontario Drinking Water Quality Standards and Monitoring for *Escherichia coli* (*E. coli*) and Total Coliforms

Background:

Part of the Ontario Drinking Water Advisory Council's mandate is to provide you with advice on proposed drinking water standards, objectives, or guidelines and their applicability in Ontario.

In order to provide comprehensive advice, the Council assesses Health Canada's Guideline Technical Documents and Guidance Documents, comments from the national public consultation process, and information on the occurrence and impact that a particular substance is likely to have on the delivery of safe drinking water in Ontario.

Based on this assessment, the Council may recommend the endorsement of a Canadian Drinking Water Quality Guideline (CDWQG) as an Ontario Drinking Water Quality Standard (ODWQS) in Ontario Regulation 169/03, or as an Objective, or a Guideline, or it may make an alternative recommendation. The Council may also conduct independent consultations with stakeholders and technical experts as deemed necessary to formulate its advice.

Health Canada has recently completed its review of *E. coli* and total coliforms in drinking water, in order to determine if there has been enough new research to warrant any updates or revisions. The Council has now also completed its review of *E. coli* and total coliforms in drinking water.

E. coli Significance and Guideline Value:

Health Canada's review maintains its past position on the use of *E. coli* as currently the most important indicator of the microbiological safety of drinking water, and the Council agrees with their conclusion which recommends none (zero) should be detected in drinking water.

Therefore:

The Council recommends that E. coli be maintained as an Ontario Drinking Water Quality Standard of Not detectable (zero) per 100 ml sample, for both treated water and distribution system water.

Total Coliforms Significance and Guideline Value:

Health Canada has recommended some changes with respect to the importance of total coliforms in that their role has been somewhat diminished in determining the microbiological safety of drinking water. The primary use of total coliform monitoring should be to assess drinking water treatment effectiveness.

To this end, the Council believes that the detection of total coliforms, in the absence of *E. coli* and / or treatment-related failures such as loss of chlorine residual, high turbidity, filter breakthrough, loss of pressure, etc. is not considered an indicator of adverse human health effects. As with the vast majority of risk assessments, many peer-reviewed references contribute to the body of evidence that has led to the Council's conclusion. Therefore:

The Council recommends that total coliforms be removed from Schedule 1 of Ontario Regulation 169 as they are no longer considered a health-based Standard.

The Council does, however, recognize that total coliforms play a useful role as an operational parameter, in that they provide information on either treatment performance (at the plant) or changes in the distribution system. As such, total coliform monitoring should still be required in order to facilitate the investigation of new positive results and / or increasing trends. Therefore:

The Council recommends that when a positive total coliform result is detected in treated water or distribution system water, Corrective Action must be initiated per Schedule 17-6 or 18-6 in Regulation 170, (starting with re-sampling and testing) as soon as reasonably possible, and if the retested total coliform sample from the same site is positive, then an Adverse Water Quality Incident (AWQI) report must be made under Section 18 of the Safe Drinking Water Act, 2002.

Currently in Ontario, an Adverse Water Quality Incident is triggered, along with the associated Corrective Action, upon the *first* detection of total coliforms in treated water or water in a distribution system.

However, Health Canada's guideline for total coliforms recommends that, for a distribution system, "*Detection of total coliforms from consecutive samples from the same site or from more than 10% of the samples collected in a given sampling period should be investigated.*"
Therefore:

The Council recommends initiating an Adverse Water Quality Incident (AWQI) report under Section 18 of the Safe Drinking Water Act, 2002, as well as the associated Corrective Action per Schedule 17-6 or 18-6 in Reg 170, if more than 10% of the total coliform samples, collected from a distribution system in a given sampling period, test positive.

Treated Water Monitoring Frequency:

Health Canada recommends that all "municipal scale" systems, regardless of their size or type, test for *E. coli* and total coliforms, in their treated water, on a weekly basis. In Ontario, Regulation 170 only requires this weekly frequency for Large Municipal Residential systems. The Council agrees with Health Canada's recommendation. Therefore:

The Council recommends that, at a minimum, weekly testing of treated water for E. coli and total coliforms be prescribed for all Drinking Water Systems regulated by the Ministry of the Environment and Climate Change, except for:

- ***Designated Facilities supplying their own water, which should undergo a Site-Specific Risk Assessment in order to determine an appropriate Treated Water Monitoring Frequency for E. coli and total coliforms.***

Distribution System Monitoring Frequency:

Health Canada recommends, at minimum, weekly monitoring of *E. coli* and total coliforms in distribution systems, noting that smaller systems are responsible for more disease outbreaks than larger ones, and that larger systems (*greater than 5,000 population served*) should sample even more frequently. Therefore:

The Council recommends that, at a minimum, weekly testing of distribution system water for E. coli and total coliforms be prescribed for all Drinking Water Systems regulated by the Ministry of the Environment and Climate Change, except for:

- ***Designated Facilities supplying their own water, which should undergo a Site-Specific Risk Assessment in order to determine an appropriate Distribution System Monitoring Frequency for E. coli and total coliforms.***

This recommended minimum weekly frequency is higher than Ontario's current minimum requirements for some categories of Ontario Drinking Water Systems.

Health Canada Advice on Sampling Locations for *E. coli* and total coliforms:

The sampling locations selected may vary depending on the monitoring objectives. For example, fixed sampling points may be used to help establish a history of water quality within the distribution system, whereas sampling at different locations throughout the distribution system may provide more coverage of the system. A combination of both types of monitoring is common.

Distribution system drawings can provide an understanding of water flows and directions and can aid in the selection of appropriate sampling locations. The majority of samples should be taken in potential problem areas, such as low-pressure zones, temporary services, reservoirs, dead ends, areas at the periphery of the system farthest from the treatment plant, and areas with a poor previous record.

In residential-scale systems, samples are generally collected from the locations recommended by the responsible authority. More extensive sampling may be necessary, depending on the system and results from previous samples. Therefore:

The Council recommends that Health Canada's general advice on sampling locations for E. coli and total coliforms be incorporated into Ontario's Technical Support Document for Ontario Drinking Water [Quality] Standards, Objectives and Guidelines.

Procedure for Disinfection of Drinking water in Ontario:

Health Canada's Guidelines with regard to *E. coli* and total coliforms reflect more recent developments in science and changes made by other jurisdictions. The Council believes these important changes should be incorporated into the Procedure for Disinfection of Drinking water in Ontario. The current Procedure makes no mention of either of these microbiological indicators. Therefore:

The Council recommends that the Ministry of the Environment and Climate Change recognize and reference, where possible, Health Canada's Guidance related to the E. coli and Total Coliforms Guideline Technical Documents.

On-Site Microbiological Test Kits:

The Council recognizes that *E. coli* and, to a lesser degree, total coliforms are important microbiological indicators. However, the results obtained from these tests are not available until well after the water has been piped to the consumer. Therefore, reliance on their results should form only one part of a multi-barrier approach to the provision of safe drinking water. In particular, real-time monitoring for chlorine residual and turbidity are currently the most important and effective tools for monitoring the operation of a drinking water system.

The Council has become aware that many national and international jurisdictions accept and actively use on-site microbiological test kits for many different purposes, including regulatory monitoring for treated water. Results from these kits are available sooner than those from the current methods, making them a more timely management tool in the provision of safe drinking water.

Specific benefits include:

- the facilitation of rapid results, allowing operators to react sooner to problems such as suspected process upsets;
- the ability to make timely use of results from storms, runoff, and fire-fighting events;
- the availability of trend information to aid in optimization activities;
- fewer problems with respect to sample transport issues in remote locations; and
- the promotion of innovation in drinking water safety in Ontario.

As well, since the current Standards for both *E. coli* and total coliforms are both “*none detectable* [zero] *per 100 ml sample*”, presence-absence testing could satisfy monitoring requirements. Presence-absence testing has advantages over quantitative methods in that it is more economical, technically simpler and the initial sample processing time is quicker. Therefore:

The Council believes that encouraging and enabling the use of on-site microbiological test kits for E. coli and total coliforms could result in increased public health protection and demonstrates due diligence.

It should be noted that some of the recommendations in the Council’s above advice will require amendments to Regulation 170, as well as other supporting documentation.

In summary, the Council feels that its recommendations on *E. coli* and total coliforms will enable continuous improvement in the safety of drinking water for Ontarians.

Sincerely,

Original Signed by Jim Merritt

Jim Merritt, Chair
Ontario Drinking Water Advisory Council

Appendix E - Advice on Ontario's Nitrate, Nitrite Standards and Ammonia

40 St. Clair Avenue West
7th Floor
Toronto, Ontario
M4V 1M2

Tel 416.212.7779
Fax 416.314.9237

40, avenue St. Clair ouest
7^e étage
Toronto, Ontario
M4V 1M2

Tél 416.212.7779
Télééc 416.314.9237



Ontario

Advisory Council on Drinking Water
Quality and Testing Standards

Le Conseil consultatif sur les normes
de qualité et d'analyse de l'eau
potable

January 20, 2015

The Honourable Glen Murray
Minister of the Environment and Climate Change
77 Wellesley Street West
11th Floor, Ferguson Block
Toronto, Ontario
M7A 2T5

Dear Minister Murray:

Re: Advice on the Ontario Drinking Water Quality Standards for Nitrate and Nitrite

Part of the Ontario Drinking Water Advisory Council's mandate is to provide you with advice on proposed drinking water standards, objectives, or guidelines and their applicability in Ontario.

In order to provide comprehensive advice, the Council assesses Health Canada's Guideline Technical Documents and Guidance Documents, comments from the national public consultation process, and information on the occurrence and impact that a particular substance is likely to have on the delivery of safe drinking water in Ontario.

Based on this assessment, the Council may recommend the endorsement of a Canadian Drinking Water Quality Guideline (CDWQG) as an Ontario Drinking Water Quality Standard (ODWQS) in Ontario Regulation 169/03, or as an Objective, or a Guideline, or it may make an alternative recommendation. The Council may also conduct independent consultations with stakeholders and technical experts as deemed necessary to formulate its advice. The Council has now completed its review of nitrate and nitrite in drinking water.

Nitrate and nitrite occur naturally in the environment, and as a result of human activities, such as certain agriculture practices. The main route of human exposure is from the ingestion of food and water. Nitrite, which is more toxic than nitrate, is also formed by the reduction of nitrate by oral bacteria. Approximately 20 percent of ingested nitrate may be converted to nitrite. Therefore, additional assessment, which considers the conversion of nitrate to nitrite upon ingestion of drinking water, may be required to properly determine if the combined levels pose a health risk.

Health Canada, through the Federal-Provincial-Territorial process, recently completed its review of all identified health risks associated with nitrate and nitrite in drinking water, assessing new studies and approaches, and considering the availability of appropriate treatment technology. Based on their review, Health Canada has chosen to reaffirm the previous (1987) CDWQGs at a maximum acceptable concentration (MAC) of 10 mg/L for nitrate and 1 mg/L for nitrite.

These MACs are health-based values, derived from human studies at the point where no adverse health effects have been observed. They are protective of the most sensitive subpopulations (i.e. nitrite relating to methaemoglobinemia in bottle-fed infants, and the more recently discovered potential thyroid effects from nitrate in school-aged children).

Health Canada's MACs are identical to Ontario's current Regulation 169/03 ODWQs for Nitrate of 10 mg/L and Nitrite of 1 mg/L; the Council concurs with their reaffirmation and the maintaining of Ontario's current ODWQs.

Limits in other jurisdictions, such as the United States Environmental Protection Agency and the World Health Organization, are also the same as Health Canada's MACs and Ontario's ODWQs.

The Council recommends that the Ministry of the Environment and Climate Change maintain the current Ontario Drinking Water Quality Standards for nitrate of 10 mg/L and nitrite of 1 mg/L.

Ontario also has an additional ODWQS for the sum of Nitrate + Nitrite of 10 mg/L, but no new health risk information can be gained from combining these measurements. As well, there is no corresponding Health Canada CDWQG, and most other jurisdictions do not use this measure.

The Council recommends that the Ministry of the Environment and Climate Change remove the current Ontario Drinking Water Quality Standard for Nitrate + Nitrite from Regulation 169/03.

With the more recently identified potential for thyroid effects on school-aged children from exposure to elevated levels of nitrite, specific notice should be taken in cases where both nitrate and nitrite are detected in Drinking Water Systems serving this sensitive subpopulation.

Ammonia Considerations:

The presence of free ammonia in a distribution system may promote nitrification, which in turn might increase levels of nitrate and nitrite. Health Canada recommends that the level of free ammonia entering a distribution system be limited to concentrations below 0.1 mg/L, and preferably below 0.05 mg/L (measured as ammonia-nitrogen), in order to prevent nitrification.

Also of note is that nitrification may result in the reduction of disinfectant residual, resulting in decreased microbiological protection in the distribution system.

Finally, utilities using ammonia as part of their disinfection strategy (e.g. chloramine), or those that have elevated levels of ammonia in their source water, should ensure that an appropriate chlorine to ammonia ratio is maintained. Changes in free ammonia concentrations can also be an indication that nitrification is occurring; thus, monitoring should be conducted both at the treatment plant and in the distribution system. Therefore:

The Council recommends that the Ministry of the Environment and Climate Change update the Technical Support Document for Ontario Drinking Water [Quality] Standards, Objectives and Guidelines to provide direction on managing ammonia and nitrate/nitrite concerns.

Since Health Canada's reaffirmed CDWQGs for nitrate and nitrite are identical to both ODWQS, maintaining these Standards will not result in any increased regulatory burden, and will facilitate the continued safety of drinking water for Ontarians.

Sincerely,

Original Signed by Jim Merritt

Jim Merritt, Chair
Ontario Drinking Water Advisory Council

Appendix F - Relevant Legislation

- *Safe Drinking Water Act, 2002, Sections 4-5*

Advisory Council on Drinking-water Quality and Testing Standards

4. (1) The Minister shall establish an advisory body known in English as the “Advisory Council on Drinking-water Quality and Testing Standards” and in French as “Conseil consultatif sur les normes de qualité et d’analyse de l’eau potable” to consider issues relating to standards for drinking-water quality and testing and to make recommendations to the Minister. 2002, c. 32, s. 4 (1).

Appointment of members

(2) The members of the Advisory Council shall be appointed by the Minister. 2002, c. 32, s. 4 (2).

Notice

(3) The Advisory Council may publish information in the Registry. 2002, c. 32, s. 4 (3).

Consideration by Minister

5. The Minister shall ensure that all recommendations of the Advisory Council on Drinking-water Quality and Testing Standards are taken into consideration in establishing and revising standards under this Act for drinking-water quality and testing. 2002, c. 32, s. 5.

Appendix G - Council Members' Biographies

Dr. Susan Andrews is a Professor of Civil Engineering at the University of Toronto and was previously an Associate Professor of Civil and Environmental Engineering at the University of Waterloo. She earned both her B.Sc. and her M.Sc. in Chemistry at the University of Alberta, and her PhD in Civil Engineering also at the University of Alberta. Dr. Andrews has been an Associate Program Leader (Infrastructure) and Research Management Committee member for the Canadian Water Network, former director of the Walkerton Clean Water Centre and former Chair of the Ontario Water Works Association.

Ian Douglas has over 25 years of experience in design, research, and plant operations in the industrial and environmental sector. He earned degrees in both Chemistry (1984) and Chemical Engineering (1987) from the University of Western Ontario. As Water Quality Engineer for the City of Ottawa, he has worked on more than 50 research and optimization projects with various research organizations and universities. During 2007 Ian spent a 1-year work term at Health Canada working on microbial risk assessment and treatment guidelines. During 2010, he was appointed as Adjunct Professor in Civil Engineering at the University of Toronto.

Michèle Giddings has 28 years of experience in drinking water-related science, policy and research. She is the Manager of the Water Quality and Science Division in the Water and Air Quality Bureau, Healthy Environments & Consumer Safety Branch, Health Canada and is a member of Health Canada's Secretariat for the Federal / Provincial /Territorial Committee on Drinking Water. Ms. Giddings is also a member of the World Health Organization's Drinking Water Quality Committee which is responsible for the development of the World Health Organization's Guidelines for Drinking Water Quality. Ms. Giddings has also developed a number of drinking water guidelines and policy documents for Health Canada and the World Health Organization. She is also a member of the America Water Works Association (AWWA), the Ontario Water Works Association (OWWA) and was previously on the Board of Directors of the Canadian Association for Laboratory Accreditation (CALA [formerly CAEAL]).

Derek Hill is a professional engineer with over 28 years of experience in planning, project management, design, contract administration and construction of infrastructure projects including buildings. Mr. Hill is a member of the Seneca Nation from the Six Nations of the Grand River Territory. He has worked for Public Works Canada, Mushkegowuk Council, private consulting, the Town of Fort Erie, and Six Nations Council. Since 2009, he has worked with the Ontario First Nations Technical Services Corporation as a Senior Engineer out of the Toronto office. In this role he provides engineering, construction and technical advisory services to First Nations and Tribal Councils across Ontario. The projects involve all types of infrastructure including buildings from concept through to commissioning of the facilities.

Rod Holme is a consultant with broad technical and project management experience in municipal water supply. In addition to his role as a Vice President in a major international consulting company, he has also played an active role in professional Associations. He has served as Chair of the Ontario Water Works Association, President of the American Water Works Association, and most recently as Chair of a Joint Committee of the Ontario Water Works and Ontario Municipal Water Associations in providing input into the Walkerton Inquiry, and working with the Ontario Ministry of the Environment in implementing the Inquiry recommendations. Mr. Holme is also a member of the Australian Water Association, having graduated as a Bachelor of Engineering from the University of Sydney and started his career with Sydney Water.

Dr. Peter Huck is a Professor and NSERC Chair in Water Treatment in the Department of Civil Engineering at the University of Waterloo. The mission of the Chair, which is now in its fifth five-year term, is to conduct fundamentally based yet practically oriented research related to drinking water. Dr. Huck is well respected internationally and served as a member of the Expert Panel for Part I of the Walkerton Inquiry.

Dr. Alexander Hukowich is the former Medical Officer of Health for the Haliburton, Kawartha, Pine Ridge Health Unit and coroner for Northumberland County, and was nominated for the Council by the Association of Local Public Health Agencies.

Dr. Robert Lannigan is the Program Head Laboratory Medicine, London Health Sciences Centre, Pathology and Laboratory Medicine, Department of Pathology and Laboratory Medicine, Schulich School of Medicine and Dentistry, Western University. Dr. Lannigan is also a Professor of Pathology and Laboratory Medicine, Microbiology and Immunology and Medicine, Western University, as well as a member of the American Society of Microbiology, and the Association of Medical Microbiology and Infectious Diseases, Canada, and is also a member of the Ontario Medical Association.

Jim Merritt is a senior consultant focused on environmental consulting, municipal infrastructure and water management. Mr. Merritt has assisted clients with managing regulatory issues, operational and organizational planning and strategic assessments of environmental situations. Mr. Merritt was the Assistant Deputy Minister of Operations Division with the Ontario Ministry of the Environment, responsible for environmental protection and regulatory services, including approvals and environmental assessments. Mr. Merritt also led the establishment of the Ontario Clean Water Agency and was the vice-president responsible for water and wastewater plant operations, engineering services, computer systems and information management. While with the Ministry of the Environment, Mr. Merritt served in various Directorship positions, including Central Region, Policy and Planning Branch, and the Administrative Services Branch, and is currently the Chair of the Advisory Council on Drinking Water Quality and Testing Standards.

Dr. Ken Roberts, of Toronto, is a Professional Engineer who has been active in the field of water resources management and engineering for more than 40 years. His professional experience in the Ontario Ministry of the Environment, with XCG Consultants Ltd. and as a private consultant, has encompassed both water and wastewater policy, treatment and research with a primary focus on drinking water. Dr. Roberts maintains many international contacts and supports the drinking water industry in numerous capacities through his American Water Works Association professional involvement.

John Rudnickas was the Manager of Water Quality for the City of Toronto. A chemist by trade, Mr. Rudnickas has extensive experience in all aspects of quality assurance / quality control in large drinking water systems, and was responsible for the management of the City of Toronto's accredited and licensed laboratory for drinking water testing. Mr. Rudnickas is currently involved with the Walkerton Clean Water Centre in the training of drinking water operators, and is a member of the Ontario Water Works Association and is on the Water Quality Committee of the Canadian Water and Wastewater Association. Mr. Rudnickas is also a member of the American Water Works Association.

Dr. Janice Sargeant is a Food Animal Veterinarian and currently Director of the Centre for Public Health and Zoonoses at the University of Guelph. She is a former Faculty member at the Kansas State University College of Veterinary Medicine and in the Department of Clinical Epidemiology and Biostatistics at McMaster University. Dr. Sargeant is a member of the Biosecurity Research Institute Advisory Committee at Kansas State University. She is also a former panel member of the Council of Canadian Academies "Healthy Animals, Healthy Canada: The expert Panel on Animal Health Risk Assessment". She received her Doctor of Veterinary Medical degree and a Ph.D. in Epidemiology from the University of Guelph.

Joanne Thompson is a hydrogeologist and Senior Group Leader, Development Hydrogeology with R.J. Burnside & Associates Limited. Ms. Thompson is a professional geoscientist and has more than 25 years of experience working in aquifer characterization, groundwater supply and water quality assessment. She holds a B.Sc. in Geology from McMaster University and a M.Sc. in Petroleum Hydrogeology from the University of Alberta. She serves as Director and Communications Officer for the Canadian National Chapter of the International Association of Hydrogeologists.

Robert Walton, a Professional Engineer, is the Director of Public Works for the County of Oxford. He is the former Manager of Water and Wastewater Services. Prior to joining the County of Oxford, Mr. Walton worked as a consulting engineer. Mr. Walton represents the Ontario Municipal Water Association as the co-chair of the Joint Executive Committee with the Ontario Water Works Association.

Appendix H - Contact Information

Mailing Address:

Ontario Drinking Water Advisory Council
40 St. Clair Avenue West, 7th Floor
Toronto, Ontario, Canada
M4V 1M2

Chair:

Jim Merritt (*Retired as of May 31, 2015*)
416-314-3606
jim.merritt@ontario.ca

Staff:

Scott Barrett, Executive Secretary
416-212-7596
scott.barrett@ontario.ca

Iris Biggar, Administrative Assistant
416-212-7779
iris.biggar@ontario.ca

Fax:

416-314-9237

Website:

www.odwac.gov.on.ca



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Ontario Drinking Water Advisory Council

www.odwac.gov.on.ca