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TO:	CHAIR AND MEMBERS OF THE CIVIC WORKS COMMITTEE MEETING ON APRIL 23, 2012
FROM:	JOHN BRAAM, P.ENG. ACTING EXECUTIVE DIRECTOR, PLANNING, ENVIRONMENTAL & ENGINEERING SERVICES & CITY ENGINEER
SUBJECT:	DRINKING WATER FLUORIDATION IN LONDON

RECOMMENDATION

That, on the recommendation of the Acting Executive Director, Planning, Environmental & Engineering Services & City Engineer, Municipal Council **RECEIVE** this report for information, and **APPROVE** a resolution stating the following:

WHEREAS at the municipal election of 1966, a plebiscite was conducted and Londoners voted in favour of fluoridation of the public water supply of the City;

AND WHEREAS the City of London's drinking water has been fluoridated since September, 1967, as per City of London By-law No. A.-3694-18, as authorized by the Fluoridation Act, and as regulated by the Ministry of the Environment;

AND WHEREAS at the Global Consultation on Oral Health Through Fluoride (2006), the World Health Organization (WHO), the World Dental Federation and the International Association for Dental Research reaffirmed the efficiency, cost-effectiveness, and safety of the daily use of optimal fluoride, and confirmed that universal access to fluoride for dental health is a part of the basic human right to health;

AND WHEREAS more than 90 national and international public health agencies have endorsed the use of fluoride at recommended levels to prevent tooth decay;

AND WHEREAS the U.S. Centers for Disease Control and Prevention declared fluoridation of drinking water to be one of the ten great public health achievements of the 20th century;

AND WHEREAS in June of 2011, Health Canada released the results of a multi-year, systematic review of the health risks associated with fluoride in drinking water and concluded that *"The weight of evidence from all currently available studies does not support a link between exposure to fluoride in drinking water at 1.5 mg/L and any adverse health effects..."*

AND WHEREAS the aforementioned Health Canada review also stated that *"... the optimal concentration of fluoride in drinking water for dental health has been determined to be 0.7 mg/L for communities who wish to fluoridate. This concentration provides optimal dental health benefits and is well below the MAC (Maximum Acceptable Concentration of 1.5 mg/L) to protect against adverse effect";*

AND WHEREAS in April of 2011, Dr. Arlene King, Ontario's Chief Medical Officer of Health issued a statement expressing concern *"about the loss of fluoridated drinking water in certain communities in spite of consistent evidence that water fluoridation is safe and effective";*

AND WHEREAS in February of 2011, the Board of Health for the Middlesex-London Health Unit unanimously supported the recommendation of Dr. Graham Pollett, Medical Officer of Health to *"support the ongoing fluoridation of the City of London's drinking water supply as a measure to achieve optimal dental/oral health for all residents, which is an important component of total health";*

THEREFORE BE IT RESOLVED THAT the Corporation of the City of London affirms its confidence in the integrity and recommendations of the World Health Organization, Health Canada, Ontario's Chief Medical Officer of Health, and the Medical Officer of Health for the Middlesex-London Health Unit, and thus supports the ongoing fluoridation of the City of London's drinking water.

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PREVIOUS REPORTS PERTINENT TO THIS MATTER

- Requests to Discontinue Water Fluoridation in London, October 6, 2008, Environment and Transportation Committee, Agenda Item #2
- Update Regarding Water Fluoridation in London, November 28, 2011, Built and Natural Environment Committee, Agenda Item #2
- Drinking Water Fluoridation in London, January 25, 2012, Civic Works Committee, Agenda Item #1

PREAMBLE

Council and Administration periodically receive correspondence from concerned citizens asking that drinking-water fluoridation be discontinued. Such correspondence typically contains references to purported adverse health effects associated with fluoridation. In 2008, Health Canada assembled an expert panel to conduct a thorough review of the health risks and benefits associated with drinking-water fluoridation. At that time, Administration recommended that Council take no action until staff reported on the results of the Health Canada review.

In June 2011, the results of the Health Canada review were made public, and Administration prepared a report which was presented to the Built and Natural Environment Committee (BNEC) on November 28, 2011. Noting that there were members of the public in attendance who wished to speak to the report, the BNEC opted to defer reception of the report until a Public Participation Meeting (PPM) could be organized. Staff were directed to invite representatives from Health Canada and the Middlesex-London Health Unit to participate in the PPM.

On January 25, 2012, the Civic Works Committee (CWC) received the staff report at a special Public Participation Meeting held in Centennial Hall. The meeting opened with a 30 minute joint presentation by the Director of Water and City Engineer, followed by Dr. Peter Cooney, Chief Dental Officer, Health Canada, and Drs. Graham Pollett and Bryna Warshawsky of the Middlesex-London Health Unit. The public participation portion of the meeting then commenced, and 59 individuals made presentations. 13 presentations were given by medical/dental professionals in support of drinking water fluoridation, and 46 presentations were opposed to fluoridation.

Given the large volume of information presented, and the lateness of the hour when the presentations were completed, the CWC opted not to discuss the report at that time, but made the following recommendation to Council in the 3rd Report of the Civic Works Committee:

Recommendation: *That following actions be taken with respect to the matter of drinking water fluoridation in the City of London:*

- a) *the comments and submissions received at the Public Participation Meeting held on January 25, 2012 with respect to drinking water fluoridation in the City of London BE REFERRED to the Civic Administration for review, in consultation with the Middlesex-London Health Unit, and report back at a future meeting of the Civic Works Committee with a recommendation and information clarifying the following matters:*

- (i) the legal issues around 'informed consent';*
- (ii) alternatives, other than nutrition, when water is not fluoridated;*
- (iii) the toxicity of HFSA (hydrofluorosilicic acid), the product used to fluoridate London's water; and,*
- (iv) whether the Municipal Council has the legal authority to make the decision to cease fluoridation of the water supply; and,*

- b) *in the event that a recommendation is put forth that the fluoridation of the City of London's drinking water should cease, the Civic Administration BE REQUESTED to address the necessary steps and associated implications of moving in that direction*

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given that the Elgin Area and Lake Huron Primary Water Supply Systems are jointly operated by municipalities in addition to the City of London, and, further, the City of London has agreements in place for the provision of water to other municipalities from its own secondary water supply system...

Administration's report on the findings of the Health Canada review is presented below, and includes the original Appendices 'A', 'B' and 'C'. Appendix 'D' provides a summary of the issues raised by the 46 individuals who made public presentations on January 25, 2012 opposing drinking-water fluoridation, and Appendix 'E' contains responses to the issues listed in Appendix 'D', as prepared by City of London and Middlesex-London Health Unit staff.

BACKGROUND

Fluoride is a naturally occurring mineral which is present in virtually all water sources. Water found in North America has natural fluoride concentrations ranging from 0.1 mg/L to more than 12 mg/L, with surface water sources (lakes and rivers) tending to have lower fluoride levels than ground water (wells). The City of London receives water from Lakes Huron and Erie, which have relatively low fluoride levels of about 0.1 mg/L. In the early part of the 20th century, it was observed that communities with low natural fluoride levels in their water experienced higher rates of dental caries (tooth decay). Subsequent research confirmed the important role that fluoride plays in preventative oral health.

Fluoridation of drinking water is now practiced by water systems worldwide. The process consists of the controlled addition of fluoride to water with naturally low fluoride levels, thereby raising the fluoride content to an optimal level for the promotion of dental health.

Fluoridation of the City of London's drinking water has been performed since September of 1967, following a public plebiscite in which London's electorate voted in favour of fluoridation.

Research into the health effects of water fluoridation has been ongoing for over 70 years, and the world's foremost dental and medical organizations support and promote the practice. Regardless, there is opposition to water fluoridation, and Council and Administration periodically receive correspondence asking that the practice be ceased.

In October 2008, Administration presented a report to Council advising that City of London staff had recently met with Dr. Neil Farrell, Director, Dental Services of the Middlesex-London Health Unit, at his request, to discuss the most appropriate way to respond to repeated requests to cease fluoridation. Dr. Farrell reported that dental decay is the most common chronic childhood disease. As with many health conditions, there is a strong relationship between low income levels and tooth decay, and it is difficult for a significant portion of the population to pay for necessary dental care. In any poverty reduction strategy, it must be the goal to minimize health problems by maximizing preventive measures, including the use of fluoridated water to prevent tooth decay and its associated problems.

Dr. Farrell also expressed concern that the assertions made in presentations opposing fluoridation cannot be adequately addressed in the limited time allowed at a public meeting or Council session. A typical presentation may include dozens of allegations, quotations and references. In order to properly evaluate the presentation, each argument would need to be fully investigated by qualified personnel in order to determine its authenticity, context and validity; taking into consideration the full spectrum of information available. Dr. Farrell then advised that Health Canada was about to commence just such an exercise through a national consultation process on the Technical Support Document regarding the Canadian Drinking Water Guideline for fluoride in drinking water. This public consultation process would provide an opportunity for all concerned parties to present arguments pertaining to the risks and benefits associated with fluoridation of drinking water.

Health Canada periodically assembles expert panels to conduct these sorts of reviews, and provides them adequate time and resources to evaluate all current information. This process allows all municipalities to benefit from the expert analysis provided, and eliminates the need for multiple jurisdictions to duplicate the evaluation process.

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DISCUSSION

a) Fluoridation Products

Fluoride is a naturally occurring mineral found in rock formations throughout the earth's crust. Water taken from the natural environment contains many minerals, including fluoride, due to the rocks and minerals that the water contacts in nature. There is no such thing as artificial fluoride; all fluoride ions are chemically identical, whether found in natural water sources, or in the rocks and minerals which are mined in order to extract the fluoride.

The source of London's fluoride is a type of rock called fluorapatite, which is mined and processed in Florida, where it is quite abundant. These rocks are rich in both fluoride and phosphorus. The rocks are processed by dissolving them in acid, which allows the fluoride and the phosphorus to be separated, creating hydrofluorosilicic acid and phosphoric acid. Hydrofluorosilicic acid is used for water fluoridation, and phosphoric acid is an important ingredient in chemical fertilizer.

In Canada, the regulation of water treatment products is a provincial responsibility. In Ontario, the Ministry of the Environment (MOE) is the regulating authority. Through London's Municipal Drinking Water Licence, the MOE dictates that any chemicals used to treat the drinking water shall meet all applicable standards set by the American National Standards Institute (ANSI).

"NSF/ANSI Standard 60: Drinking Water Chemicals - Health Effects", is the MOE mandated standard for fluoridation products. The NSF/60 Standard is even more stringent than the USP-NF Standard for fluorides used to produce pharmaceuticals. NSF/60 was developed using U.S. EPA and Health Canada criteria to determine that fluoridation products are safe at their maximum use level, and to evaluate potential contaminants in the products. NSF/60 requires testing of the treatment chemical products, typically by dosing them in water at 10 times the maximum use level, so that trace levels of contaminants can be detected. An evaluation of the test results is required to determine if any contaminant concentrations have the potential to cause adverse human health effects, as per U.S. EPA and Health Canada drinking water guidelines. NSF certifies three products in the fluoridation category:

1. Hydrofluorosilicic acid (the fluoridation product used in London)
2. Sodium fluorosilicate
3. Sodium fluoride

London's drinking water operators review the Certificate of Analysis that is provided with each shipment of hydrofluorosilicic acid, to ensure that it has been tested to meet the NSF/60 Standard.

Hydrofluorosilicic acid (HFSA) is the most commonly used fluoridation product in North America. It has the chemical formula H_2SiF_6 . This means that HFSA is composed of hydrogen ions* (*electrically charged atoms), silicon ions and fluoride ions. When HFSA is added to drinking water, it becomes completely dissociated; that is, by interacting with water molecules, the ions separate from each other and disperse into the water. Because of this dissociation, the HFSA that is added to the water actually ceases to exist. The net effect of adding HFSA to the drinking water is that the amount of fluoride, hydrogen and silicon is increased, but no HFSA exists in the water after it is added.

Members of Council have recently received multiple pieces of correspondence claiming that hydrofluorosilicic acid has not had safety studies or toxicology testing for human consumption. Hydrofluorosilicic acid is used for fluoridation worldwide because when it is added to drinking water, it dissociates into its constituent ions and immediately ceases to exist as hydrofluorosilicic acid. People do not ingest hydrofluorosilicic acid when they drink fluoridated water. When researchers and public health officials speak about the safety and effectiveness of fluoridated water, they are referring to water that has been fluoridated with one of the approved fluoridation products; of which, hydrofluorosilicic acid is the most widely used.

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b) World Health Organization

The World Health Organization (WHO) is the directing and coordinating authority for health within the United Nations system. It is responsible for providing leadership on global health matters, shaping the health research agenda, setting norms and standards, articulating evidence-based policy options, providing technical support to countries, and monitoring and assessing health trends. According to the WHO constitution, "*the enjoyment of the highest attainable standard of health is one of the fundamental rights of every human being...*" With respect to water fluoridation, the WHO states on their website that "*Fluoridation of water supplies, where possible, is the most effective public health measure for the prevention of dental decay.*" The WHO also asserts that "*universal access to fluoride for dental health is a part of the basic human right to health.*"

c) Health Canada

To properly evaluate the risks and benefits of water fluoridation requires a tremendous commitment of time and effort by informed medical and dental professionals. When evaluating the risks and benefits of a practice such as water fluoridation, health experts employ a process known as a systematic review. A systematic review is a literature review focused on a research question that tries to identify, appraise and synthesize all high quality research evidence relevant to that question. Through the Federal-Provincial-Territorial Committee on Drinking Water, Health Canada periodically assembles expert panels to conduct systematic reviews of their Guideline Technical Documents. Through this process, the most current research findings are evaluated and incorporated into the Guidelines. In January of 2007, Health Canada began conducting such an exercise with respect to the "*Guidelines for Canadian Drinking Water Quality - Guideline Technical Document - Fluoride*". Health Canada referred to over 400 published scientific studies and included a public consultation process in which interested parties were invited to supply additional information and commentary for consideration. All submitted information was reviewed, and Health Canada released the final 104-page report in June 2011.

The "*Executive summary*" of the Health Canada review is attached as Appendix 'A', along with the "*Health effects*" summary and the "*Dental health benefits*" summary. The following are a few excerpts from the review:

- "*This review assesses all identified human health risks, taking into account new studies and approaches. Based on this review, the guideline for fluoride in drinking water is a Maximum Acceptable Concentration (MAC) of 1.5 mg/L*"
- "*The weight of evidence from all currently available studies does not support a link between exposure to fluoride in drinking water at 1.5 mg/L and any adverse health effects, including those related to cancer, immunotoxicity, reproductive/developmental toxicity, genotoxicity and/or neurotoxicity. It also does not support a link between fluoride exposure and intelligence quotient deficit, as there are significant concerns regarding the relevant studies, including quality, credibility, and methodological weaknesses*"
- "*Health Canada's Chief Dental Officer has reviewed the available science on dental effects of fluoride, and sought external expert advice from the scientific dental community. Experts provided a recommendation on the optimal level, which was accepted by Health Canada's Chief Dental Officer. As a result, the optimal concentration of fluoride in drinking water for dental health has been determined to be 0.7 mg/L for communities who wish to fluoridate. This concentration provides optimal dental health benefits and is well below the MAC to protect against adverse effect*"

The City of London has been fluoridating to a target value of 0.7 mg/L since the early-1990s, in accordance with recommendations provided by the Director, Dental Services, of the Middlesex-London Health Unit.

One of the concerns expressed by groups opposed to water fluoridation is the possibility of a link between fluoride ingestion and osteosarcoma (a type of bone cancer). According to the International Association for Dental Research, "*The controversy over whether there is an association between fluoride and risk for osteosarcoma has existed since an inconclusive*

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animal study 20 years ago". In July, 2011, after the release of the Health Canada review, a much anticipated Harvard School of Public Health study was published in the Journal of Dental Research. The purpose of this study, titled "An Assessment of Bone Fluoride and Osteosarcoma", was to determine if bone fluoride levels were higher in people with osteosarcoma. This case-control study detected no significant association between bone fluoride levels and osteosarcoma risk.

d) Ontario's Chief Medical Officer of Health

In April of 2011, Dr. Arlene King, Ontario's Chief Medical Officer of Health issued a News Release expressing her support for drinking water fluoridation. Dr. King discussed the benefits and safety of drinking water fluoridation and expressed her concern "about the loss of fluoridated drinking water in certain communities in spite of consistent evidence that water fluoridation is safe and effective." Dr. King's News Release is presented as Appendix 'B'.

e) Middlesex-London Health Unit

On February 17, 2011, the Board of Health for the Middlesex-London Health Unit (MLHU) received a staff report recommending that the Board of Health "...support the ongoing fluoridation of the City of London's drinking water supply as a measure to achieve optimal dental/oral health for all residents, which is an important component of total health." (reproduced as Appendix 'C'). The MLHU report reviewed the history of water fluoridation and current practices in the City of London, and discussed the safety and effectiveness of water fluoridation. The report noted that the fluoridation of London's water costs approximately \$133,000 per year, or about 38 cents per London resident per year. The MLHU report also noted estimates that for every \$1 invested in community water fluoridation, \$38 in dental treatment costs are avoided. A public participation forum was held and several speakers presented arguments in opposition to fluoridation. The Board of Health voted unanimously to support the staff recommendation. The results of the aforementioned Health Canada review support this Board of Health decision.

At the request of a member of Council, the Board of Health received a second staff report on April 14, 2011, which reviewed the findings of the "Review of the U.S. National Research Council Report: Fluoride in Drinking Water". The U.S. National Research Council report's main intent was to assess the health effects of much higher levels of natural fluoride in the U.S. However, there were some findings that related to lower levels of fluoride (such as those in London's water) which, according to the Health Unit report, did not indicate any health concerns.

CONCLUSIONS

In developing, implementing and evaluating policies and programs, Council regularly makes decisions on a diverse array of topics. Some of these decisions involve in-depth analyses of highly technical or scientific information. In such cases, Council must rely upon external expertise to provide analysis and recommendations. For matters pertaining to public health, governments have established local, provincial, federal and international public health agencies to promote wellness, prevent disease, and protect the public's health. These public health agencies provide the expert analysis of current scientific data that governments rely upon to make informed decisions regarding the health of their constituents.

As with other issues of public health policy, there are individuals and organizations who disagree with the conclusions and recommendations of public health agencies regarding water fluoridation. Council and Administration periodically receive correspondence from concerned citizens asking that fluoridation be discontinued. Such correspondence typically contains references to purported adverse health effects associated with fluoridation. The authors of such correspondence are essentially asking Council to evaluate the authenticity and validity of a select fraction of the large volume of material that was recently evaluated by Health Canada, and to then arrive at a different conclusion than the Health Canada experts. In essence, Council is being asked to disregard the expert analysis and recommendations of local, provincial, federal and international public health agencies.

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Administration recommends that Council not abandon the practice of relying upon the expertise provided by our public health officials; but rather, that Council affirm its confidence in the integrity and recommendations of World Health Organization, Health Canada, Ontario's Chief Medical Officer of Health, and the Medical Officer of Health for the Middlesex-London Health Unit, and thus support the ongoing fluoridation of the City of London's drinking water.

Addendum

At the January 25, 2012 Public Participation Meeting, numerous issues were raised in presentations opposing drinking water fluoridation. Administration has listed these issues in Appendix 'D', and through collaboration with the Middlesex-London Health Unit has provided responses in Appendix 'E'. Similarly, when Health Canada conducted the recent review of their fluoride guideline, they included a public consultation phase in which interested parties were invited to submit material for review. Health Canada received and reviewed large volumes of material that presented arguments opposing drinking-water fluoridation. All submitted material was reviewed by Health Canada's expert panel before the final report was released.

As evidenced by the responses in Appendix 'E', Administration is not aware of any new issues raised at the Public Participation Meeting that have not been previously addressed by Health Canada and/or other researchers. After thoroughly reviewing the issues raised on January 25, 2012, Administration does not believe that there is any justification for altering the recommendation provided in this report.

Acknowledgements

This report has been prepared with input from:

- Dr. Graham Pollett, Medical Officer of Health, Middlesex-London Health Unit (MLHU)
- Dr. Bryna Warshawsky, Associate Medical Officer of Health, MLHU
- Dr. Maria vanHarten, Dental Consultant, MLHU
- Paul Sharma, Manager, Oral Health, MLHU
- Roland Welker, Division Manager, Water Engineering, City of London
- Dan Huggins, Water Quality Manager, City of London

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Appendix 'A'

Excerpts from the Guidelines for Canadian Drinking Water Quality – Guideline Technical Document – Fluoride, 2011

Executive summary

Low levels of fluoride occur naturally in most sources of drinking water in Canada. Fluoride can occur naturally in surface waters from the deposition of particulates from the atmosphere and the weathering of fluoride-containing rocks and soils, and in groundwater from leaching from rock formations. Fluoride is also introduced in the environment by a variety of human activities such as chemical manufacturing plants and waste ponds; the manufacture of aluminum, steel, glass, enamel, brick, tile, pottery, and cement; production of fluorinated chemical and phosphate fertilizer; and metal casting, welding, and brazing.

Health Canada recently completed its review of the health risks associated with fluoride in drinking water. This review assesses all identified human health risks, taking into account new studies and approaches. Based on this review, the guideline for fluoride in drinking water is a Maximum Acceptable Concentration of 1.5 mg/L.

Health effects

Dental fluorosis is the most widely and frequently studied of all adverse effects of fluoride. It is the effect occurring at the lowest level of fluoride exposure in the population. Mild and very mild dental fluorosis are not considered to be adverse effects, whereas moderate dental fluorosis is found to be an adverse effect, based on its potential cosmetic concern, and is used as the endpoint of concern in the risk assessment used to establish the Maximum Acceptable Concentration. By protecting against a cosmetic effect of moderate dental fluorosis, Canadians are also protected against the adverse health effects of severe dental fluorosis. Skeletal fluorosis is the most serious adverse health effect clearly associated with prolonged exposure to high levels of fluoride in drinking water. Skeletal fluorosis can occur at very high exposure levels, and has rarely been documented in Canada.

The weight of evidence from all currently available studies does not support a link between exposure to fluoride in drinking water at 1.5 mg/L and any adverse health effects, including those related to cancer, immunotoxicity, reproductive/developmental toxicity, genotoxicity and/or neurotoxicity. It also does not support a link between fluoride exposure and intelligence quotient deficit, as there are significant concerns regarding the relevant studies, including quality, credibility, and methodological weaknesses.

Dental health benefits

Health Canada's Chief Dental Officer has reviewed the available science on dental effects of fluoride, and sought external expert advice from the scientific dental community. Experts provided a recommendation on the optimal level, which was accepted by Health Canada's Chief Dental Officer. As a result, the optimal concentration of fluoride in drinking water for dental health has been determined to be 0.7 mg/L for communities who wish to fluoridate. This concentration provides optimal dental health benefits and is well below the MAC to protect against adverse effects.

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Appendix 'B'

News Release

Communiqué

DRINKING WATER FLUORIDATION

STATEMENT FROM DR. ARLENE KING, CHIEF MEDICAL OFFICER OF HEALTH

NEWS

April 4, 2011

As Chief Medical Officer of Health for Ontario, I am very concerned about the loss of fluoridated drinking water in certain communities in spite of consistent evidence that water fluoridation is safe and effective.

Support for Water Fluoridation

More than 90 national and international professional health organizations, including Health Canada, the Canadian Public Health Association, the Public Health Agency of Canada, the Canadian Dental Association, the Canadian Medical Association, the U.S. Centers for Disease Control and Prevention (CDC) and the World Health Organization, have endorsed the use of fluoride at recommended levels to prevent tooth decay. In fact, the use of fluoride in drinking water has been called one of the greatest public health achievements of the 20th century by the CDC.

Benefits of Water Fluoridation

Combats Tooth Decay

The benefits of water fluoridation are well documented. According to expert research, fluoridated drinking water reduces the number of cavities in children's teeth, which contributes to their healthy development. Reductions of tooth decay have also been observed in adults and seniors who reside in communities with fluoridated water. Even with other sources of fluoride available today, the American Dental Association estimates that water fluoridation continues to be effective in reducing tooth decay by 20-40 per cent.

Conversely, removing fluoride from drinking water systems has the potential to contribute to increased rates of tooth decay. The findings of several studies, including from the CDC, suggest that tooth decay generally increases in a population after water fluoridation is discontinued. In addition, a 2007 report on water fluoridation by the Institut National de Santé Publique du Québec reveals that the percentage of kindergarten children at high risk of developing tooth decay in Dorval, Quebec doubled in the two year period after water fluoridation was halted in 2003.

Reduces Dental Care Expenditures and Inequalities in Health

Water fluoridation also has the capacity to help reduce dental care expenditures. The Ontario Dental Association has stated that the cost of waiting until tooth decay has manifested is significantly higher than the cost of preventing it in the first place. The CDC estimates \$38 in avoided costs for dental treatment for every \$1 invested in community water fluoridation. With the fluoridation of drinking water playing an important role in the overall promotion of good oral health and prevention of dental decay, I am concerned that removing it from drinking water may put a strain on, and impact the success of, important provincial programs such as the Children in Need of Treatment Program and Healthy Smiles Ontario - both developed to benefit those least able to afford dental services.

And indeed, removing fluoride from drinking water will place those least able to afford or access dental treatment at an increased risk for oral health problems. The health benefits of drinking water fluoridation extend to all residents in a community, regardless of age, socioeconomic status, education or employment.

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Safety of Fluoridated Drinking Water

Fluoride in drinking water is also safe. In Ontario, fluoride additives are required to meet rigorous standards of quality and purity before they can be used. When they are added to water at levels recommended in Ontario and across the country, studies have not linked fluoride to cancer, bone fractures or intelligence levels. Studies have also found that water fluoridation is safe for the environment, and poses no risk to plants and animals.

In addition, most dental fluorosis, a condition that occurs when a child receives too much fluoride during tooth development, is mild and appears as white stains on the teeth. In this mildest form, fluorosis may affect the look of a tooth, but will not affect its function. While moderate or severe fluorosis does occur, the Canadian Health Measures Survey: Oral Health Statistics 2007-2009 concludes that, "[so] few Canadian children have moderate or severe fluorosis that, even combined, the prevalence is too low to permit reporting. This finding provides validation that dental fluorosis remains an issue of low concern in this country."

Good Oral Health Means Good Overall Health

The importance of maintaining good oral health should not be taken lightly - it is an important part of being healthy overall. As tooth decay is the single most common chronic disease among Canadians of all ages and poor oral health is linked to diabetes, heart disease and respiratory conditions, water fluoridation is, and must be recognized as, a very important public health measure. An estimated 70 per cent of Ontarians currently have access to water that is fluoridated, and I would urge all Ontarians to continue to support the fluoridation of their municipal drinking water systems so that everyone can enjoy the lasting health benefits.

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Appendix 'C'

Board of Health Report - February 17, 2011

MIDDLESEX-LONDON HEALTH UNIT
REPORT NO. 014-11

TO: Chair and Members of the Board of Health
FROM: Graham L. Pollett, MD, FRCPC, Medical Officer of Health
DATE: 2011 February 17

Fluoridation of the City of London's Drinking Water

Recommendation

It is recommended that the Board of Health support the ongoing fluoridation of the City of London's drinking water supply as a measure to achieve optimal dental/oral health for all residents, which is an important component of total health.

Addendum: On February 17, 2011, the Board of Health unanimously voted to support the ongoing fluoridation of the City of London's drinking water supply as per the above recommendation.

Introduction

The Board of Health has considered water fluoridation in several past Board of Health Reports including: Report No. 043-07 re Ontario Fluoridation Office (March 2007), Report No. 107-07 re Request to Establish an Ontario Fluoridation Office (June 2007), Report 111-08 re Water Fluoridation (September 2008) and Report No 006-09 re Water Fluoridation (January 2009) (Appendix A). As well, on October 16, 2008, the Board of Health heard a presentation by Mrs. Carole Clinch, Research Coordinator for the People for Safe Drinking Water, entitled "To Stop Water Fluoridation."

The purpose of this current Board of Health Report is to seek the Board of Health's support for the ongoing fluoridation of London's drinking water. This report will provide an overview of water fluoridation in London including background information on fluoride such as how it works, how its benefits were discovered and its importance as a public health strategy; the process for fluoridating and monitoring London's water and the cost of this process; and the benefits and safety of water fluoridation.

Background

It is increasingly recognized that oral/dental health is an important component of total health. Cavities (also known as tooth decay or dental caries) are holes in the teeth that if left unchecked can lead to pain, infection in the mouth and occasionally in the body, and loss of the tooth. To prevent or alleviate the pain, the hole in the tooth must be filled or the tooth extracted. Despite significant declines in tooth decay over the past decades, it remains a very common chronic childhood disease. A survey of dental indices among Ontario Health Units from 1979 to 2008 revealed that 34% of 5-year-olds had evidence of decay, with even higher rates in older children. Similarly, results from Middlesex-London in 2007-2008 indicated that 35% of 1,264 5-years olds had evidence of ever having tooth decay.

Fluoride is a naturally occurring mineral that has been proven to prevent tooth decay. Fluoride affects the enamel of the teeth such that it stops, or potentially reverses the tooth decay process. Fluoride's main effect occurs after the tooth has erupted into the mouth, as small amounts of fluoride in saliva frequently bathe the tooth. Ingesting high levels of fluoride when the teeth are being formed may cause fluorosis, a cosmetic condition where the teeth have white spots, and in severe cases the teeth can be pitted or have brown stains.

The benefits of fluoride in preventing tooth decay were discovered in the 1930s and 1940s. It was noted that communities with high rates of fluorosis also had low rates of tooth decay. Both the fluorosis and lack of decay were attributed to high levels of natural fluoride in the drinking water. In the 1940s, studies were conducted to assess the effect of low levels of fluoride in drinking water on tooth decay. When comparing cities with fluoride added to the water and non-fluoridated water, it was determined that cities receiving fluoridated water had 50-70% lower rates of tooth decay. Based on amounts of water consumed, a safe level of fluoride was determined that decreased tooth decay without increasing the risk of fluorosis.

By the 1980s, the difference in decay rates between communities with fluoridated and non-fluoridated water had narrowed, in part due to the fact that non-fluoridated cities were also receiving fluoride through foods and beverages that are bottled and processed in areas with fluoridated water (referred to as the "halo effect") and also due to the widespread use of toothpaste with fluoride. Nonetheless, studies have still continued to demonstrate the benefits of fluoridation of the water, and studies where fluoridation is stopped demonstrate an increase in rates of tooth decay, approaching the levels in the non-fluoridated

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group. Fluoridation ensures benefit to all those who drink the water, regardless of socioeconomic status, age, ability to regularly brush teeth, or access to dental care.

The Ontario Ministry of the Environment (MOE) estimates that 70% of Ontario residents receive water that is fluoridated, either naturally or by adding fluoride to the water. As of 2005, community fluoridated drinking water was provided to 43% of Canadians. In the United States, approximately 67% of the population receives optimally fluoridated water. Fluoridation of drinking water is less common in European countries although some countries fluoridate their salt.

Fluoride has been recognized by the United States Center for Disease Control and Prevention as one of the ten great public health achievements of the twentieth century and is supported by numerous public health and oral/dental health organizations. It is estimated that for every \$1 invested in community water fluoridation, \$38 in dental treatment costs are avoided. In Middlesex-London alone, \$596,045 was spent in 2009 to cover the cost of urgent dental treatment for children aged 0-17 years whose families could not afford the cost. For many individuals, particularly those over 17 years of age, financial limitations present a major barrier to accessing basic dental care, making strategies that focus on prevention of dental disease, such as fluoride, very important.

Fluoridation in London

The MOE stipulates that where fluoride is added to drinking water, the concentration be adjusted to 0.5 - 0.8 mg/L, the optimum level for control of tooth decay. The City of London receives its water from two sources – about 85 % from Lake Huron and 15% from Lake Erie. The natural level of fluoride in both these water sources is approximately 0.1 mg/L. This level is too low to prevent tooth decay. As per Ontario's Fluoridation Act, a plebiscite was held in London in 1966 through which residents voted to have fluoride added to the water. Beginning in 1967, Lake Huron water has been fluoridated at the Arva Pumping Station before distribution within London. In 1996, the City of London connected to the Lake Erie system which adds fluoride at the Elgin Area Water Treatment Plant. It should be noted that fluoride is not added to water in any jurisdiction in Middlesex County, although fluoride levels are naturally higher in the Thorndale area.

Addendum: It should also be noted that fluoridated water from the City of London water supply is provided to Arva, Ballymote and Delaware in Middlesex County.

The level of fluoride in London's water is maintained at 0.7 mg/L to provide optimal protection against tooth decay without increased risk of dental fluorosis. The level is continually monitored by the City of London and monthly summaries are provided to the Health Unit. Health Unit staff also provides advice to residents of Middlesex-London on other measures to prevent dental fluorosis such as: not using fluoridated toothpaste for the first two years of life and after that, using only a pea-sized amount of fluoridated toothpaste under adult supervision without swallowing and not using fluoride supplements such as pills or drops. A screening conducted by Health Unit staff in 2006 revealed that London had very low rates of fluorosis of cosmetic concern; of note, the rate in London, where the water is fluoridated (5%), was similar to Strathroy, where the water is not fluoridated (4.6%).

To add fluoride to London's drinking water, hydrofluorosilicic acid is used. The source of this product is an ore that is mined and processed in Florida which is rich in fluoride and phosphorus. The processing involves separating the fluoride from the phosphorus, with the fluoride being used to create hydrofluorosilicic acid and the phosphoric acid being used to create chemical fertilizer. Any substance that is added to drinking water is required to pass rigorous testing to ensure that it meets the high standards that are legislated for the water industry such as the National Sanitation Foundation and American National Standards Institute (NSF/ANSI) Standards for purity. The NSF/ANSI Standards for fluoride products added to drinking water are even more stringent than the US standards that apply to fluoride products used in pharmaceuticals.

A detailed costing of the fluoridation of London's water was done by Mr. Dan Huggins, Water Quality Manager for the City of London. Including annual operating costs and amortized capital costs, the fluoridation of London's water costs approximately \$133,000 per year, or about 38¢ per each London resident.

Benefits and Safety of Water Fluoridation

Many research articles have been written with regard to the benefits and safety of water fluoridation. Several systematic reviews (where experts review the scientific papers and draw conclusions based on the papers that are judged to be scientifically sound) have been published. These review papers provide strong support for the ongoing fluoridation of water for the prevention of tooth decay. A summary of the key findings of these reports and the position of credible scientific organizations can be found in Appendix B which is a memo from Dr. David Williams, the Associate Chief Medical Officer of Health for Ontario. Aside from fluorosis, which is very infrequent when levels of fluoride are kept at 0.7 mg /L as in the City of London, the papers also provide no evidence of harm from fluoridation of the water. To quote the most recent review entitled "Fluoride in Drinking Water," which was conducted by Health Canada and issued

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for public comment on November 27, 2010: **(Erratum: This report closed for public comment on November 27, 2009)**

"The weight of evidence from all currently available studies does not support a link between exposure to fluoride in drinking water at 1.5 mg/L and any adverse health effects, including those related to cancer, immunotoxicity, reproductive/developmental toxicity, genotoxicity and/or neurotoxicity. It also does not support a link between fluoride exposure and intelligence quotient deficit, as there are significant concerns regarding the available studies, including quality, credibility, and methodological weaknesses."

There is also no evidence that fluoride in water has any negative effects on the environment.

Conclusion

The scientific evidence strongly supports the fluoridation of water to prevent tooth decay. The evidence also provides reassurance as to the safety of this important public health strategy. It is recommended that the Board of Health endorse the recommendation to support the ongoing fluoridation of London's water supply as a public health measure to achieve optimal dental/oral health, which is an important component of total health.

This report was prepared by Dr. Bryna Warshawsky, Associate Medical Officer of Health and Director, Oral Health, Communicable Disease and Sexual Health Services.

Graham L. Pollett, MD, FRCPC
Medical Officer of Health

- **This report addresses** the following requirement(s) of the Ontario Public Health Standards:
Child Health

Appendices available upon request

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Appendix 'D'

Summary of Comments Provided at the January 25, 2012 Public Participation Meeting of the Civic Works Committee

At the January 25, 2012 Public Participation Meeting of the Civic Works Committee, presentations in support of drinking-water fluoridation were provided by Dr. Peter Cooney, Chief Dental Officer, Health Canada, and Drs. Graham Pollett and Bryna Warshawsky of the Middlesex-London Health Unit.

Dr. Cooney expanded upon the findings of the recent Health Canada review, and provided insight into the evaluation process used. He concluded by re-stating that "Health Canada continues to recognize the benefits of community water fluoridation, and supports it as a safe and effective method to prevent tooth decay."

Drs. Pollett and Warshawsky discussed the mechanisms by which fluoride reduces tooth decay and the supportive findings of several recent systematic reviews performed in Great Britain, the United States, Australia, and Canada. They further discussed the value of water fluoridation in London, the process by which public health policy is formulated and evaluated, and the unanimous recommendation of the Board of Health for the Middlesex-London Health Unit supporting the ongoing fluoridation of London's drinking water.

In the public participation portion of the meeting, thirteen (13) medical and dental professionals also spoke in support of fluoridation, including:

- Ontario's Chief Medical Officer of Health
- The Vice-President of the Royal College of Dental Surgeons of Ontario
- The Director of the Dr. Sandy Kirkley Centre for Musculoskeletal Health, Lawson Health Research Institute, Schulich School of Medicine and Dentistry, University of Western Ontario
- The Acting Director of Dentistry, Schulich School of Medicine and Dentistry, University of Western Ontario
- The Past President of the Ontario Dental Association (an Adjunct Professor in Oral Medicine at the Schulich School of Medicine and Dentistry, University of Western Ontario)
- A representative of the Ontario Association of Public Health Dentistry
- The Manager of Professional Development, Canadian Dental Hygienists Association
- A representative of the Ontario Dental Hygienists' Association
- The Executive Director of the Ontario Dental Assistants Association
- The President of the London and District Dental Society
- A Certified Specialist of Pediatric Dentistry and Adjunct Clinical Professor Schulich School of Medicine and Dentistry, University of Western Ontario
- A Certified Specialist of Pediatric Dentistry practicing in London

In the public participation portion of the meeting, forty-six (46) people spoke in opposition to drinking-water fluoridation. In the list below, staff have summarized the issues raised. As per the direction of the Civic Works Committee, staff have reviewed these issues in consultation with the Middlesex-London Health Unit. Responses to these issues are presented in Appendix 'E'. Some responses deal with several of the issues raised; and for ease of reference, the corresponding "Response #" is listed in parentheses following each issue listed below.

1. Water fluoridation is unethical and unlawful as it amounts to medicating citizens without their informed consent. (Response # 1)
2. Fluoride is a medicine; therefore it requires labeling, dosage instructions, etc. (Response # 1)
3. It is illegal to add to add HFSA to drinking water. (Response # 1)
4. Topical fluoride applications are more effective than drinking-water fluoridation. (Response # 2)
5. Cheaper /safer alternatives are available - drops, tablets, etc. (Response # 2)

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6. 99% of water is not consumed, therefore it would be more cost effective for people to individually fluoridate their drinking water if they so choose. (Response # 2)
7. Since only 1% of water is consumed, 99% of our fluoridation costs are wasted money. (Response # 2)
8. There have been no toxicology studies or clinical trials for HFSA exposure. (Response # 3)
9. HFSA is toxic industrial waste; a by-product of phosphate fertilizer production which contains contaminants. (Response # 3)
10. HFSA is industrial grade fluoride, not pharmaceutical grade. (Response # 3)
11. HFSA is radioactive. (Response # 3)
12. HFSA is classified as a Dangerous Good by Environment Canada TDG regulations and a Class 8 Corrosive. (Response # 3)
13. The fluoride added to London's water is not the same as naturally-occurring fluoride. (Response # 3)
14. HFSA does not dissociate completely. (Response # 3)
15. HFSA re-associates in the stomach. (Response # 3)
16. On December 31, 2012, the Standard of Care provision of the Safe Drinking Water Act will be proclaimed into law, making Councillors liable if harm is caused by fluoridation. (Response # 5)
17. Council will be responsible if harm occurs due to fluoridation - not health agencies, as they only recommend fluoridation. (Response # 5)
18. Fluoride dosage cannot be controlled because water consumption cannot be controlled. (Response # 6)
19. People with diabetes drink large amounts of water and are more exposed to fluoride. (Response # 6)
20. Cavity rates have declined in non-fluoridated communities, just as in fluoridated communities. (Response # 7)
21. Fluoride has a topical effect only; there is no benefit gained by ingesting it. (Response # 8)
22. Fluoride does not decrease rates of tooth decay. (Response # 9)
23. Ceasing fluoridation will have no impact on cavity rates. (Response # 10)
24. Ceasing fluoridation causes a decrease in cavity rates. (Response # 10)
25. Vitamin D is more effective in preventing cavities and has no side effects. (Response # 11)
26. Health organizations warn that baby formula should not be made with fluoridated water. (Response # 12)
27. The American Dental Association has acknowledged that children under 12 months of age should not drink fluoridated water. (Response # 12)
28. Fluoride is genotoxic/mutagenic. (Response # 13)
29. Fluoride interferes with iodine uptake. (Response # 14)
30. Fluoride displaces iodine in the body. (Response # 14)
31. Fluoride causes thyroid problems. (Response # 14)
32. Fluoride causes endocrine disruption. (Response # 14)
33. Fluoride facilitates the bio-availability of aluminum and assists aluminum to cross the blood-brain barrier. (Response # 15)
34. Fluoride causes brain/neurological disorders. (Response # 16)
35. Fluoride causes diabetes. (Response # 17)
36. Fluoride causes skeletal problems. (Response # 18)
37. Fluoride causes hip fractures. (Response # 19)
38. Fluoride causes cancer. (Response # 20)
39. Fluoride causes osteosarcoma. (Response # 21)
40. Fluoride causes decreased body weight. (Response # 22)
41. Fluoride causes autism. (Response # 23)
42. Fluoride causes hyperactivity. (Response # 24)
43. Fluoride causes learning disabilities. (Response # 25)

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44. Fluoride causes cardiovascular disease. (Response # 26)
45. Fluoride causes fluorosis. (Response # 27)
46. Fluoride causes lowered IQ. (Response # 28)
47. Fluoride causes damage to the pineal gland. (Response # 29)
48. Fluoride causes birth defects. (Response # 30)
49. Fluoride causes reproductive problems. (Response # 30)
50. Fluoride causes stomach problems. (Response # 31)
51. Fluoride causes unspecified "health problems". (Response # 32)
52. The City of London does not reveal the true cost of fluoridation because it does not include the costs incurred due to the health problems caused. (Response # 32)
53. Some children are allergic to fluoride which can cause depression. (Response # 33)
54. Some segments of population are hyper-sensitive to fluoride. (Response # 34)
55. The kidneys of young children and the elderly cannot properly excrete fluoride. (Response # 35)
56. Native Americans, Latin Americans and African Americans have higher rates of diabetes and kidney disease and are therefore more susceptible to harm from fluoridated water. (Response # 36)
57. Latin Americans and African Americans have higher rates of fluorosis and are therefore more susceptible to harm from fluoridated water. (Response # 37)
58. Fluoride is absorbed through the skin during showers/baths. (Response # 38)
59. Studies have shown that fluoridated water delays tooth eruption, so it simply delays tooth decay. (Response # 39)
60. Systematic reviews are not a substitute for peer-reviewed toxicological studies. (Response # 40)
61. Cavities are not caused by a fluoride deficiency; they are caused by modern diets. (Response # 41)
62. Doctors and scientists have been wrong before. (Response # 42)
63. The York review concluded that water fluoridation is not safe, nor could be concluded to be cost-effective. (Response # 43)
64. Toothpaste tubes contain a warning to call poison control if you swallow it - therefore fluoride is toxic. (Response # 44)
65. The Hazardous Waste Act does not permit HFSA to be added to the environment, yet we return our tap water to the Thames River. (Response # 45)
66. Since it is illegal to dump HFSA in the environment, why is it okay to add it to drinking water? (Response # 45)
67. It is illegal to discharge fluoridated water to the environment. (Response # 45)
68. Environment Canada has a Fluoride Guideline of 0.12 mg/L for water discharged to the environment. (Response # 45)
69. Fluoride in our water causes unspecified "harm to the environment". (Response # 45)
70. Discontinuation of fluoridation would save taxpayers money. (Response # 46)
71. Fluoride increases lead levels in water by leaching lead from plumbing. (Response # 47)
72. Other Canadian cities have stopped fluoridating, so London should as well. (Response # 48)
73. There are other jurisdictions in Canada and around the world that do not fluoridate their water, so London shouldn't either. (Response # 49)
74. Fluoride is found in rat and cockroach poison. (Response # 50)
75. The Material Safety Data Sheet for HFSA is missing key pieces of information, and states that HFSA is a carcinogen. (Response # 51)

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Appendix 'E'

Responses to Comments Provided at the January 25, 2012 Public Participation Meeting of the Civic Works Committee

As mentioned in the preamble to this report, following the January 25, 2012 Public Participation Meeting (PPM), the following recommendation was presented to Council in the 3rd Report of the Civic Works Committee:

Recommendation: *That following actions be taken with respect to the matter of drinking water fluoridation in the City of London:*

- a) *the comments and submissions received at the Public Participation Meeting held on January 25, 2012 with respect to drinking water fluoridation in the City of London BE REFERRED to the Civic Administration for review, in consultation with the Middlesex-London Health Unit, and report back at a future meeting of the Civic Works Committee with a recommendation and information clarifying the following matters:*
- (i) the legal issues around 'informed consent';*
 - (ii) alternatives, other than nutrition, when water is not fluoridated;*
 - (iii) the toxicity of HFSA (hydrofluorosilicic acid), the product used to fluoridate London's water; and,*
 - (iv) whether the Municipal Council has the legal authority to make the decision to cease fluoridation of the water supply; and,*
- b) *in the event that a recommendation is put forth that the fluoridation of the City of London's drinking water should cease, the Civic Administration BE REQUESTED to address the necessary steps and associated implications of moving in that direction given that the Elgin Area and Lake Huron Primary Water Supply Systems are jointly operated by municipalities in addition to the City of London, and, further, the City of London has agreements in place for the provision of water to other municipalities from its own secondary water supply system...*

Administration has consulted with the Middlesex-London Health Unit to review the written submissions received at the January 25, 2012 Public Participation Meeting, as well as the oral arguments presented (through review of video). The directives of the CWC (above) are addressed below, followed by responses to each issue listed in Appendix 'D'. Some responses address multiple issues, and the heading for each response identifies the specific issues addressed. The heading also identifies whether the response was prepared by Civic Administration, or by the Middlesex-London Health Unit (MLHU).

RESPONSE # 1

- a) (i) - The legal issues around 'informed consent'
- Issue # 1 - Water fluoridation is unethical and unlawful as it amounts to medicating citizens without their informed consent.
- Issue # 2 - Fluoride is a medicine; therefore it requires labeling, dosage instructions, etc.
- Issue # 3 - It is illegal to add to add HFSA to drinking water

Part A (Administration)

The ethical aspects of drinking-water fluoridation were very recently addressed in the province of Quebec. Whereas fluoridation is a common practice in Ontario and the United States, it is relatively uncommon in Quebec. The Public Health Ethics Committee (CESP) of the National Public Health Institute of Québec was recently asked to comment upon the ethics of drinking water fluoridation.

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On March 21, 2012, the CESP released their report (1), and the Executive Summary is reproduced below:

EXECUTIVE SUMMARY

"This opinion relates to a project submitted by the National Public Health Director to amend the Regulation respecting the quality of drinking water of the Ministère du Développement durable, de l'Environnement et des Parcs (MDDEP – Ministry of Sustainable Development, Environment and Parks) to include a mandatory minimum standard for fluoride of 0.7 mg/l for all Québec municipalities with populations of 5,000 or more.

Tooth decay and its consequences are a major public health concern affecting the entire Québec population. By way of illustration, tooth decay affects 42% of the province's kindergarten children. In addition, Québec children have 40% more cavities than their counterparts in Ontario and the United States. In Québec, dental treatment costs exceed \$2 billion.

The fluoridation of drinking water is presented in the literature as one of the safest, most effective, economical and equitable ways of reducing tooth decay. It has a greater impact on disadvantaged populations, and thus helps reduce health inequalities. The negative effects of fluoridation on health and the environment are not significant enough to outweigh the benefits.

However, the fluoridation of a population's water supply system will inevitably run counter to the wishes of part of that population. To force people to live more healthily against their will is certainly not a trivial matter. It is therefore important to explore ways to mitigate the consequences of such a measure on the free choice of individuals.

In conclusion, the CESP takes the view that the benefits of fluoridation outweigh its potential negative effects on health and the environment and that such benefits justify impinging on the freedom of choice of people who do not wish to have their water fluoridated. This opinion offers ways to mitigate these negative consequences on target populations; these include informing and consulting the public and inviting it to participate in the process leading to the change in regulations on the quality of drinking water."

With respect to the legality of adding HFSA to municipal drinking water, Ontario's Fluoridation Act, 1990 provides municipalities with the legal authority to fluoridate as follows:

"Where a local municipality or a local board thereof owns or operates a waterworks system, the council of the municipality may by by-law establish, maintain and operate, or require the local board to establish, maintain and operate, a fluoridation system in connection with the waterworks system."

In Ontario, the Ministry of the Environment (MOE) dictates that any chemicals used to treat the drinking water shall meet all applicable standards set by the American National Standards Institute (ANSI). "NSF/ANSI Standard 60: Drinking Water Chemicals - Health Effects", is the MOE mandated standard for fluoridation products. NSF certifies three products in the fluoridation category:

1. Hydrofluorosilicic acid (or HFSA, the fluoridation product used in London)
2. Sodium fluorosilicate
3. Sodium fluoride

The City of London Solicitor's Office has provided the following information with respect to the legal aspects of informed consent:

The issue of informed consent has been raised in several Canadian cases. Generally the issue is framed as whether fluoridation of public water amounts to the administration of a drug without the informed consent of the people being medicated. This is often tied to section 7 of the

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Charter and the right to life, liberty and security of the person and the right not to be deprived thereof except in accordance with the principles of fundamental justice.

*In the 2003 BC case *Millership v. British Columbia* (affirmed by BC Court of Appeal and leave to appeal to Supreme Court of Canada denied), the plaintiff sought a declaration that public water fluoridation mass medicates and poisons Canadians by the drug fluoride without their informed consent. The court denied the declaration, and in doing so the court determined that the fluoridation of water was done pursuant to the authority of a by-law after a referendum in support of such by-law by the majority of the residents of the community. The court stated that members of a community are able to obtain information about the fluoridation of water if they wish, and are given an opportunity to debate the issue and take steps to avoid fluoridated water if they wish.*

*The court also referred to the case *Locke v. Calgary (City)* where the court found that the by-law did not violate the plaintiff's rights to security of the person, and that in any event such a by-law would be saved by principles of fundamental justice which required a fair balance to be struck between the interests of a person whose claim to security had been violated and those of society. The court in *Locke* also held that the intrusion by the judiciary into value judgments of the legislature and the electors must be restrained unless there is a clear breach of the Charter established on at least a balance of probabilities by the proponent of such breach.*

- (1) Comité d'éthique de santé publique. Opinion on a project to fluoridate drinking water. March, 2012

Part B (MLHU)

Fluoride used in drinking water fluoridation is not considered a drug by Health Canada as per the *Food and Drugs Act* and is not regulated by the federal government as a drug (1). Fluoride is considered a non-essential mineral nutrient for the prevention of dental disease. Fluoride added to water in the concentrations available in Canada is considered nutritive as opposed to therapeutic. Fluoride is added to drinking water as a public health measure to protect dental health and prevent or reduce tooth decay.

Nutrients are components of food that help to nourish the body. They provide energy, serve as building material, or help to maintain or repair body parts. Prevention of chronic disease may be considered to be a factor in deciding essential nutrients for the body. (2) Fluoride is considered a non-essential mineral nutrient for the prevention of dental disease. Health Canada considers fluoride to be a beneficial mineral nutrient that occurs naturally in most sources of drinking water. (3)

In a recent report, the World Health Organization (WHO) lists fluoride as one of the 14 minerals considered important for good health (2). Due to its health benefits, the Institute of Medicine of the National Academies of Sciences declared that fluoride was an important nutrient (4) and a report by the U.S. Surgeon General in 2004 states that fluoride is a nutrient that is potentially beneficial for bones. (5)

When a fluoride preparation, such as a dental rinse or toothpaste, includes a therapeutic claim and is represented for sale in Canada, it is considered to be a drug and is regulated accordingly by Health Canada. It is the responsibility of the product submission sponsor to demonstrate compliance with the applicable federal requirements.

Governments and health professionals have a responsibility to make decisions and implement public health strategies that balance community health outcomes with individual choices. Adjusting the level of fluoride in drinking water can be compared to practices such as adding iodine to salt for thyroid health and adding folic acid to cereals to reduce neural tube defects.

- (1) Department of Justice Canada. *Food and Drugs Regulations*. Ottawa, Ontario: 2011.
 (2) World Health Organization. *Nutrients in Drinking Water*. Geneva: 2005.
 (3) Health Canada. *Fluoride in Drinking Water*. Environmental and Workplace Health. [Online] 2011. [Cited: July 22, 2011.]
http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/healthsante/faq_fluoride-fluorure-eng.php

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- (4) Food and Nutrition Board of the Institute of Medicine. Dietary Reference Intakes: Calcium, Phosphorus, Magnesium, Vitamin D, and Fluoride. Washington D.C.: National Academy Press, 1997.
- (5) US Department of Health and Human Services. Bone Health and Osteoporosis: A Report of the Surgeon General. Rockville M.D.: Office of the Surgeon General, 2004. p. 166.

RESPONSE # 2 (MLHU)

- a) (ii) - Alternatives, other than nutrition, when water is not fluoridated
- Issue # 4 - Topical fluoride applications are more effective than drinking-water fluoridation
- Issue # 5 - Cheaper /safer alternatives are available - drops, tablets, etc.
- Issue # 6 - 99% of water is not consumed; therefore it would be more cost effective for people to individually fluoridate their drinking water if they so choose
- Issue # 7 - Since only 1% of water is consumed, 99% of our fluoridation costs are wasted money

While other fluoride application modalities may be as effective or more effective than community water fluoridation, community water fluoridation is the most cost-effective and equitable preventive measure. Community water fluoridation in London costs approximately 38 cents per person per year, and is accessible to all Londoners. Fluoridated water reaches the entire community, regardless of socioeconomic status, education, income or race/ethnicity. (1)

MLHU staff estimated the costs of three alternative methods of delivering fluoride to residents of the City of London.

Alternatives to community water fluoridation aim to provide a benefit as close to that of community water fluoridation as possible. The financial considerations include "All High Risk" groups comprising three major groups who are at higher risk of oral health problems:

- Children
- Seniors
- Individuals who live on low income as defined by the Statistics Canada Low-Income Cut-Off. This includes individuals on the Ontario Disability Support Program and on Ontario Works.

The three alternative models proposed and costed are:

MODEL #1: Topical application of fluoride by Middlesex-London Health Unit employees in newly established dental clinics, and a supportive educational campaign

MODEL #2: Topical application of fluoride in private dental offices, and a supportive educational campaign

MODEL #3: Provision of free toothbrushes and fluoride-containing toothpaste through a mail-out program, and a supportive educational campaign

Assumptions:

- Costs of topical application in the Middlesex-London Health Unit-run clinics and the private dentist offices are for the recommended frequency of twice per year.
- It was determined that identifying addresses for all households with children, seniors and people of low income would not be possible, and would not significantly reduce costs; therefore, costs for the mail out program are for an annual delivery of a yearly supply of toothbrushes and toothpaste to all households in London through a distribution company.

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The Table below provides a summary of the capital, operating, and other costs of each option, including the required Full Time Equivalent (FTE) staffing requirements. Details of these budgets are provided in Appendix 'F'.

	Population	Annual Budget (new FTEs)	One-time Capital Costs
MODEL #1: Topical application of fluoride by Middlesex-London Health Unit employees in new dental clinics, and a supportive educational campaign	152,789	\$4,817,635 63 FTEs	\$1,012,000
MODEL #2: Topical application of fluoride in private dental offices, and a supportive educational campaign	152,789	\$14,683,810 3 FTEs	\$262,000
MODEL #3: Provision of free toothbrushes and fluoride-containing toothpaste through a mail-out program, and a supportive educational campaign	378,809	\$3,746,860 3FTEs	\$132,000

It is important to note that each of the proposed models relies upon the active participation of Londoners to utilize the alternative fluoride delivery method offered. For children, the disabled, and seniors, the proposed models may depend on parents or caregivers to ensure utilization of the alternative methods.

(1) Burt, B A. Fluoridation and social equity. J Public Health Dent, 2002, 62(4): 195-200.

RESPONSE # 3 (Administration)

- a) (iii) - The toxicity of HFSA (hydrofluorosilicic acid), the product used to fluoridate London's water
- Issue # 8 - There have been no toxicology studies or clinical trials for HFSA exposure
- Issue # 9 - HFSA is toxic industrial waste; a by-product of phosphate fertilizer production which contains contaminants
- Issue # 10 - HFSA is industrial grade fluoride, not pharmaceutical grade
- Issue # 11 - HFSA is radioactive
- Issue # 12 - HFSA is classified as a Dangerous Good by Environment Canada TDG regulations and a Class 8 Corrosive
- Issue # 13 - The fluoride added to London's water is not the same as naturally-occurring fluoride
- Issue # 14 - HFSA does not dissociate completely
- Issue # 15 - HFSA re-associates in stomach

Fluoride is a naturally occurring mineral found in rock formations throughout the earth's crust. Water taken from the natural environment contains many minerals, including fluoride, due to the rocks and minerals that the water contacts in nature. There is no such thing as artificial fluoride; all fluoride ions are chemically identical, whether found in natural water sources, or in the rocks and minerals which are mined in order to extract the fluoride.

The source of London's fluoride is a type of rock called fluorapatite, which is mined and processed in Florida. These rocks are rich in both fluoride and phosphorus. The rocks are

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processed by dissolving them in acid, which allows the fluoride and the phosphorus to be separated, creating hydrofluorosilicic acid (HFSA) and phosphoric acid. HFSA is used for water fluoridation, and phosphoric acid is an important ingredient in chemical fertilizer. It has been stated that HFSA is a by-product of fertilizer production; it would be equally valid to state that fertilizer is a by-product of HFSA production. As both phosphorous and fluoride are extracted from the same rocks through the same process, it might be most accurate to state that HFSA and fertilizer are co-products of that process.

As with any substance extracted from the natural environment, natural impurities will exist in the HFSA. Purity standards are therefore imposed before the HFSA can be added to drinking water. "NSF/ANSI Standard 60: Drinking Water Chemicals - Health Effects", is the MOE mandated standard for fluoridation products. NSF/60 was developed using U.S. EPA and Health Canada criteria to determine that fluoridation products are safe at their maximum use level with respect to potential chemical and radioactive impurities. The NSF/60 Standard is even more stringent than the USP-NF Standard for fluorides used to produce pharmaceuticals. The U.S. Centers for Disease Control and Prevention advise that:

"Some have suggested that pharmaceutical grade fluoride additives should be used for water fluoridation. Pharmaceutical grading standards used in formulating prescription drugs are not appropriate for water fluoridation additives. If applied, those standards could actually increase the amount of impurities as allowed by AWWA and NSF/ANSI in drinking water.

Given the volumes of chemicals used in water fluoridation, a pharmaceutical grade of sodium fluoride for fluoridation could potentially contain much higher levels of arsenic, radionuclides, and regulated heavy metals than a NSF/ANSI Standard 60-certified product." (1)

London's drinking water operators review the Certificate of Analysis that is provided with each shipment of hydrofluorosilicic acid, to ensure that it has been tested to meet the NSF/60 Standard.

The City of London receives HFSA in a very concentrated form. In this concentrated state, it is a corrosive acid that must be handled with appropriate precautions. Each litre of concentrated HFSA is mixed into approximately 450,000 litres of water. At this level of dilution, the HFSA molecules become completely dissociated (2); that is, by interacting with water molecules, the ions (predominantly fluoride) that make up the HFSA separate from each other and disperse into the water. Because of this dissociation, the HFSA that is added to the water actually ceases to exist. It was suggested at the Public Participation Meeting that perhaps the ions that formerly made up the HFSA molecules might re-associate in the stomach. For this to happen, the free ions would have to avoid interacting with the multitude of other compounds within the stomach, locate each other, and recombine to form molecules of HFSA. Administration is unaware of any studies that suggest this possibility.

Several speakers at the Public Participation Meeting stated that HFSA has not had safety studies or toxicology testing for human consumption. HFSA is used for fluoridation worldwide because when it is added to drinking water, it dissociates into its constituent ions and immediately ceases to exist as HFSA. People do not ingest, and are not exposed to HFSA when they drink fluoridated water. When researchers and public health officials speak about the safety and effectiveness of fluoridated water, they are referring to water that has been fluoridated with one of the approved fluoridation products; of which, HFSA is the most widely used.

(1) http://www.cdc.gov/fluoridation/fact_sheets/engineering/wfadditives.htm

(2) Finney, W.F. et al. Reexamination of Hexafluorosilicate Hydrolysis by ^{19}F NMR and pH Measurement. Environ. Sci. Technol. 2006, 40, 2572-2577

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RESPONSE # 4 (Administration)

- a) (iv) - Whether the Municipal Council has the legal authority to make the decision to cease fluoridation of the water supply and,
- b) in the event that a recommendation is put forth that the fluoridation of the City of London's drinking water should cease, the Civic Administration **BE REQUESTED** to address the necessary steps and associated implications of moving in that direction given that the Elgin Area and Lake Huron Primary Water Supply Systems are jointly operated by municipalities in addition to the City of London, and, further, the City of London has agreements in place for the provision of water to other municipalities from its own secondary water supply system...

When discussing water fluoridation in London, it must first be recognized that London receives its drinking water from two distinct water supply systems; The Lake Huron Primary Water Supply System, and the Elgin Area Primary Water Supply System. London receives 80-85% of its water from the Lake Huron system, and 15-20% is supplied by the Elgin system.

The water that London receives from the Lake Huron system is not fluoridated. The City of London adds fluoride to this water at the Arva Pumping Station.

The water that is received from the Elgin system is fluoridated at the treatment plant near Port Stanley. All of the municipalities that receive water from the Elgin system receive fluoridated water.

With respect to the water received from the Lake Huron system, section 3 of Ontario's Fluoridation Act provides municipal councils with the legal authority to cease fluoridation of the water supply as follows:

"Where a local municipality or a local board thereof has a fluoridation system in connection with its waterworks system, the council of the municipality may by by-law discontinue, or require the local board to discontinue, the fluoridation system."

Council can therefore enact a by-law that requires the discontinuation of the fluoridation system for the water received from the Lake Huron system.

With respect to the water received from the Elgin system, section 5 of Ontario's Fluoridation Act states the following:

"A fluoridation system established under subsection (1) shall be discontinued where the councils of both municipalities or of a majority of the municipalities, as the case may be, have passed by-laws requiring the discontinuance of the fluoridation system in their respective municipalities."

Subsection (1) refers to a situation *"Where a waterworks system is operated by or for two or more local municipalities"*, such as the Elgin Area Primary Water Supply System.

In other words, London's municipal council cannot unilaterally require that the Elgin system discontinue fluoridation. By-laws to that effect would need to be passed by the councils of a majority of the municipalities that comprise the Board of Management for the Elgin Area Primary Water Supply System.

With respect to the other municipalities that receive water from the City of London Water System (Arva, Ballymote and Delaware), these systems are not co-owners of London's system; they are customers that purchase water from the City of London. The situation referred to in subsection (1) above, therefore does not apply.

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RESPONSE # 5 (Administration)

- Issue # 16 - On December 31, 2012, the Standard of Care provision of the Safe Drinking Water Act will be proclaimed into law, making Councillors liable if harm is caused by fluoridation
- Issue # 17 - Council will be responsible if harm occurs due to fluoridation - not health agencies, as they only recommend fluoridation

On December 31, 2012, Section 19 of the Safe Drinking Water Act will be proclaimed into law. Section 19 is commonly referred to as the "the Standard of Care provision", and is reproduced below:

Standard of care, municipal drinking water system	19. (1) Each of the persons listed in subsection (2) shall: <ul style="list-style-type: none"> (a) exercise the level of care, diligence and skill in respect of a municipal drinking water system that a reasonably prudent person would be expected to exercise in a similar situation; and (b) act honestly, competently and with integrity, with a view to ensuring the protection and safety of the users of the municipal drinking water system. 2002, c. 32, s. 19 (1).
Same	(2) The following are the persons listed for the purposes of subsection (1): <ul style="list-style-type: none"> 1. The owner of the municipal drinking water system; 2. If the municipal drinking water system is owned by a corporation other than a municipality, every officer and director of the corporation; 3. If the system is owned by a municipality, every person who, on behalf of the municipality, oversees the accredited operating authority of the system or exercises decision-making authority over the system. 2002, c. 32, s. 19 (2).
Offence	(3) Every person under a duty described in subsection (1) who fails to carry out that duty is guilty of an offence. 2002, c. 32, s. 19 (3).
Same	(4) A person may be convicted of an offence under this section in respect of a municipal drinking water system whether or not the owner of the system is prosecuted or convicted. 2002, c. 32, s. 19 (4).
Reliance on experts	(5) A person shall not be considered to have failed to carry out a duty described in subsection (1) in any circumstance in which the person relies in good faith on a report of an engineer, lawyer, accountant or other person whose professional qualifications lend credibility to the report. 2002, c. 32, s. 19 (5).

With respect to the City of London Water System, the Standard of Care provision will include London's Municipal Councillors, among those who could be charged with an offence if they fail to exercise their responsibilities toward the operation of the water system in the manner detailed in subsection (1); i.e. to (a) exercise the level of care, diligence and skill in respect of a municipal drinking water system that a reasonably prudent person would be expected to exercise in a similar situation; and (b) act honestly, competently and with integrity, with a view to ensuring the protection and safety of the users of the municipal drinking water system.

With respect to drinking-water fluoridation, the Executive Director, Planning, Environmental & Engineering Services & City Engineer has provided this report recommending that Council

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support the ongoing fluoridation of the City of London's drinking water. This recommendation is based upon recommendations of the World Health Organization, Health Canada, Ontario's Chief Medical Officer of Health, and the Medical Officer of Health for the Middlesex-London Health Unit. These individuals and organizations have advised that not only does drinking-water fluoridation cause no harm, but that it provides significant oral health benefits.

Subsection (5) explicitly states that no person will be considered to have failed in their duties if they relied in good faith on a report of a person whose professional qualifications lend credibility to the report.

RESPONSE # 6 (MLHU)

- **Issue # 18 - Fluoride dosage cannot be controlled because water consumption cannot be controlled.**
- **Issue # 19 - People with diabetes drink large amounts of water and are more exposed to fluoride**

Health Canada is aware that different people consume different amounts of water. The risk assessment approach used by Health Canada to establish drinking water guidelines for fluoride in drinking water included an estimation of the total daily intake of fluoride from all sources of exposure for all age groups. The Maximum Acceptable Concentration of 1.5 mg/L for fluoride in drinking-water was established based on the segment of the population most at risk of developing dental fluorosis, children 1-4 years old. Health Canada calculated a Tolerable Daily Intake (TDI) value for fluoride from all sources to prevent moderate dental fluorosis in 1-4 year old children. The TDI value was calculated at 0.105 mg/kg bw/day (mg of fluoride per kg of body weight per day). (1)

A total diet survey conducted in 2007 estimated the dietary intakes of fluoride in the Canadian population. The authors found that the average dietary intake of fluoride in the 1 to 4-year-old group is estimated to be 0.026 mg/kg bw/day and 0.016 mg/kg bw/day in fluoridated and non-fluoridated communities, respectively. These values are well below Health Canada's TDI value. The average dietary intakes of fluoride in the Canadian population aged 20 years and older are estimated to vary between 0.024 to 0.033 mg/kg bw/day in non-fluoridated communities and between 0.038 to 0.048 mg/kg bw/day in fluoridated communities; also well below Health Canada's TDI value. (2)

People with uncontrolled diabetes mellitus and people with another less common kind of diabetes called diabetes insipidus can drink large amounts of water. The National Research Council report calculated the estimated daily intake of fluoride in these groups. (3) At 1.0 mg/L of fluoride in water, only those who drink very large amounts of water (eg. 2 litres per day for a child; 10 litres per day for an adult) exceeded Health Canada's tolerable daily intake of 0.105 mg/kg bw/day of fluoride. It should be noted that very high levels of water consumption would likely only occur when diabetes is not adequately controlled, since adequate treatment will lower the daily intake of water. It should also be noted that London's water is fluoridated at 0.7 mg/L, not 1.0 mg/L, which would result in less fluoride exposure even when drinking large amounts of water.

(1) Health Canada, Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Fluoride December 2010 <http://www.hc-sc.gc.ca/ewh-sert/pubs/water-eau/2011-fluoride-fluorure/index-eng.php#a916> Page 26

(Note that further references to this report will refer to it as the "Health Canada, Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Fluoride")

(2) Dabeka, R W, Carrier, R and Martinova, N. Report on fluoride levels in total diet samples and estimated dietary intakes of fluoride by Canadian adults and infants. Ottawa: Food Directorate

(3) National Research Council of National Academies, Committee on Fluoride in Drinking Water, Board on Environmental Studies and Toxicology, Division on Earth and Life Studies. Fluoride in Drinking Water: A Scientific Review of EPA's Standards. 2006. National Academies Press. Washington, D.C. http://www.nap.edu/catalog.php?record_id=11571. Pages 32-33, 35 and 65.

(Note that further references to this report will refer to it as "The National Research Council Report")

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RESPONSE # 7 (MLHU)

- **Issue # 20 - Cavity rates have declined in non-fluoridated communities, just as in fluoridated communities**

Cavity rates have declined in non-fluoridated communities for a variety of reasons. The adapting of improved hygiene habits and availability of home-use fluoridated toothpastes have been influential but cannot be credited solely for the decline. In Canada, the "halo" or "diffusion" effect has played a role. The effect occurs when foods and beverages processed in a fluoridated community are consumed in a community without fluoridation. This "diffusion" effect results in an increased fluoride exposure among people in non-fluoridated communities, which provides them increased protection against dental decay. (1) Failure to account for this effect can potentially underestimate the total benefit of water fluoridation. (2)

Where water fluoridation may not be feasible, alternative modalities may be used for fluoride delivery and this has contributed to the decline of caries. These modalities include salt fluoridation, milk fluoridation, and fluoride supplements (e.g. pills or drops). It is also important to recognize that several countries, particularly in Europe, have either universal or semi-universal dental care or school dental programs that allow residents or schoolchildren to access fluoride treatments and preventive services at little or no cost to them. (3)

The results of two recent well-conducted Danish studies indicate that despite the availability of fluoridated toothpaste and access to dental care and education, fluoride in water remains an important factor in preventing cavities.

In Denmark, municipalities must offer comprehensive dental care to all children until age 18, and nearly all toothpaste sold since the 1960s has been fluoride-containing. Despite the extensive use of fluoridated toothpaste, the first study (4) revealed that a large part of the inter-municipal variation in caries in children and adolescents could be explained by variation in naturally occurring fluoride in the drinking water supply. As the concentration of fluoride increased, the prevalence of caries decreased.

The second study (4), whose methodology included the data from 178,147 children from across the country, and which accounted for known factors that can also affect decay rates, such as family income, confirmed this correlation. This study showed that fluoride concentration in drinking water was a strong predictor of the risk of dental decay (with higher rates of decay in areas with lower natural fluoride levels in the water, and lower rates of decay with higher natural fluoride levels in the water) despite alternative sources of topical fluoride and excellent access to preventive services.

- (1) Health Canada. . Fluoride in Drinking Water. Environmental and Workplace Health. Available at http://www.hc-sc.gc.ca/ewh-semt/consult/_2009/fluoride-fluorure/draft-ebauche-eng.php#58
- (2) American Dental Association. Fluoridation Facts. Printed in US : 2005.
- (3) Ekstrand KR, Christiansen MEC, Qvist V. Influence of different variables on the inter-municipality variation in caries experience in Danish adolescents. Caries Res 2003;37:130-41.
- (4) Kirkeskov L, Kristiansen E, Bøggild H, von Platen-Hallermund F, Sckerl H, Carlsen A, Larsen MJ, Poulsen S. The association between fluoride in drinking water and dental caries in Danish children. Linking data from health registers, environmental registers and administrative registers. Community Dent Oral Epidemiol 2010; 38: 206-212.

RESPONSE # 8 (MLHU)

- **Issue # 21 - Fluoride has a topical effect only; there is no benefit gained by ingesting it**

Although initially fluoride's main effect was thought to be systemic from ingestion, the research indicates that fluoride's primary mechanism of action is topical. (1) Fluoride contained in drinking water bathes the surfaces of the teeth throughout the course of the day through drinking and rinsing. This fluoride acts to prevent cavities by assisting in the repair of the enamel on the surface of the teeth which is damaged by acid in the mouth. If left unchecked, this damage can eventually lead to cavity formation. In the processes of repairing the enamel, fluoride

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strengthens the teeth and makes them more resistant to future attacks from acid in the mouth.
(2) (3)

- (1) Health Canada. Fluoride in Drinking Water. Environmental and Workplace Health. Available at http://www.hc-sc.gc.ca/ewh-semt/consult/_2009/fluoride-fluorure/draft-ebauche-eng.php#58
- (2) Gröeneveld, A., Van Eck, A.A.M.J. and Backer Dirks, O. (1990) Fluoride in caries prevention: is the effect pre- or post-eruptive? J. Dent. Res., 69 (Spec. Iss.): 751-755.
- (3) Thylstrup, A. (1990) Clinical evidence of the role of pre-eruptive fluoride in caries prevention. J. Dent. Res., 69 (Spec. Iss.): 742-750.

RESPONSE # 9 (MLHU)

- **Issue # 22 - Fluoride does not decrease rates of tooth decay**

The best available evidence points to the contrary. According to the York review (1), the research indicates that fluoridation of drinking water supplies does reduce caries prevalence, as measured by the proportion of children who are caries free and by the average number of cavity-affected teeth. Based on the studies assessed in the York review, it was found that fluoridated areas had an average of 14.6% more children who had no cavities when compared to non-fluoridated areas.

A more recent systematic review and meta-analysis demonstrated that adults also benefit from the caries preventative effect of fluoridated water. (2) Adults with lifelong exposure to fluoridated drinking water were at reduced risk of developing tooth decay. This has important public health implications since, with the exception of water fluoridation virtually all primary preventive programs target children and youth.

See also Response #7 and Response #8 for additional information on the benefits of fluoride and its mechanism of action.

- (1) McDonagh, M.S., Whiting, P.F., Wilson, P.M., Sutton, A.J., Chestnutt, I., Cooper, J., Misso, K., Bradley, M., Treasure, E. and Kleijnen, J. (2000) Systematic review of water fluoridation. Br. Med. J., 321: 855-859.
- (2) Griffin, SO, et al. Effectiveness of fluoride in preventing caries in adults. J Dent Res, 2007, 86(5): 410-5.

RESPONSE # 10 (MLHU)

- **Issue # 23 - Ceasing fluoridation will have no impact on cavity rates**
- **Issue # 24 - Ceasing fluoridation causes a decrease in cavity rates**

If community water fluoridation ceases, an eventual increase in cavity rates among people of all ages can be expected. Numerous studies have been conducted to evaluate the impact on dental rates as a result of the discontinuation of water fluoridation.

Antigo, Wisconsin fluoridated its water supply from 1949 until 1960. Five years after ceasing fluoridation, tooth decay in second grade, fourth grade, and sixth grade schoolchildren increased 70-200%. As a result, in 1965, fluoridation was re-instituted (1). Anglesey, North Wales, had a fluoridated water supply from 1955 to 1991. From fluoridated 1987 to non-fluoridated 1993, the decay rate in 5 year old children increased 151%. (2) (3)

In 2002, an independent task force convened by the Centers for Disease Control and Prevention examined the 'before and after' measurements of caries at the tooth level. They found that initiating, or continuing, fluoridation decreased tooth decay among children aged 4 to 17 years by a median of 29.1% during 3 to 12 years of follow-up. They also discovered that discontinuation of fluoridation was associated with a median increase of 17.9% in dental caries during 6 to 10 years of follow-up. (4)

Prior to the discontinuation of fluoridation in Dryden, Ontario, decay rates for 4 to 5 year old children had shown a continual decline from the time of inception. However, after fluoridation

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was discontinued in 2001, children within the community's schools showed an increase in decay rates of approximately 26%.

Community water fluoridation in Dorval was discontinued in 2003. In the 2-year period that followed, the percentage of kindergarten children at high risk of developing dental cavities doubled: rising from 8% to 17%. (5)

Some fluoridation cessation studies have produced results different than those described above. In these research papers (6) (7) (8) (9), decay rates did not increase with the discontinuation of fluoride. The authors of these papers consistently noted that preventive service utilization either increased after fluoridation cessation (6) (8) or aggressive public topical fluoride and/or sealant programs were already in place (7) (9). One group of Finnish researchers stressed that their findings of non-increasing decay rates "must not be extrapolated to countries with less intensive preventive dental care" (7), as would be the case in Ontario.

- (1) Lemke, C W, Doherty, J M and Arra, M C. Controlled fluoridation: the dental effects of discontinuation in Antigo, Wisconsin. J Am Dent Assoc, 1970, 80:7882-6.
- (2) Thomas, F, Kassab, J and Jones, B. Fluoridation in Anglesey 1993: a clinical study of dental caries in 5-year old children who had experienced sub-optimal fluoridation. Br Dent J, 1995, 178(2):55-9.
- (3) Hulse, G, et al. Welsh water should reinstate fluoridation on Anglesey. Br Dent J, 1995, 178(2): 46-47.
- (4) Truman, B I, et al. Reviews of evidence on interventions to prevent dental caries, oral and pharyngeal cancers, and sports-related craniofacial injuries. Am J Prev Med, 2002, 23(Suppl 1): 21S-54S.
- (5) Levy, M. Update on Water Fluoridation in Quebec (French) from INSPQ Water fluoridation: An analysis of the health benefits and risk. 2007. 9e Quebec Public Health Meeting.
- (6) Maupome G, Clark DC, Levy SM, Berkowitz J. (2001). Patterns of dental caries following the cessation of water fluoridation. Community Dentistry and Oral Epidemiology 29: 37-47.
- (7) Seppa L, Karkkainen S, Hausen H, M. Larmas (2002). Caries Occurrence in a Fluoridated and a Nonfluoridated Town in Finland: A Retrospective Study Using Longitudinal Data from Public Dental Records. Caries Research 36 (5): 308-314.
- (8) Kunzel W, Fischer T, Lorenz R, Bruhmann S. (2000). Decline of caries prevalence after the cessation of water fluoridation in the former East Germany. Community Dentistry
- (9) Kunzel W, Fischer T. (2000). Caries prevalence after cessation of water fluoridation in La Salud, Cuba. Caries Research 34: 20-5.

RESPONSE # 11 (MLHU)

- **Issue # 25 - Vitamin D is more effective in preventing cavities and has no side effects**

Vitamin D's main function is to maintain blood levels of calcium and phosphorus within the normal physiologic range to support metabolic functions, neuromuscular transmission, and bone mineralization. (1) Optimal vitamin D intake is required during bone formation to prevent rickets and is also thought to be integral to tooth development. (1) Although some researchers in the 1930s anecdotally observed that vitamin D deficiency in childhood was associated with weak enamel (2) (3) (4), no modern study has shown that vitamin D supplementation reduces the incidence of childhood caries. (5)

Vitamin D is not believed to have any direct cavity-fighting properties, and therefore would be an ineffective preventive measure.

Vitamin D in high doses does have side effects. Excessive doses of vitamin D in addition to usual dietary sources and fortified foods can result in hypervitaminosis whose symptoms include nausea, vomiting, and weakness; related to high calcium levels in the blood (hypercalcemia). (6)

- (1) Holick, M.F. Vitamin D. In Modern nutrition in health and disease. 10th edition. M. Shils et al., editors. Lippincott Williams & Wilkins. Baltimore, Maryland, USA. 2005. 329-345.
- (2) Hess, A.F. Rickets including osteomalacia and tetany. Lea & Febiger. Philadelphia, Pennsylvania, USA. 1929. 401-429.
- (3) Hess, A.F. Collected writings. Volume 1. Charles C. Thomas. Springfield, Illinois, USA. 1936. 669-719.

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- (4) Elliot, M.M., and Park, E.A. Rickets. In Brennemann's practice of pediatrics. Volume 1. W.F. Prior Company Inc. Hagerstown, Maryland, USA. 1938. 1-110.
- (5) Schroth et al. Prevalence of caries in preschool-aged children in a Northern Manitoba Community. J Can Dent Assoc, 2005, 71 (1), 27.
- (6) Kulie, T. et al. Vitamin D: an evidence-based review. J Am Brd Med, 2009, 22: 698-706.

RESPONSE # 12 (MLHU)

- **Issue # 26 - Health organizations warn that baby formula should not be made with fluoridated water**
- **Issue # 27 - The American Dental Association has acknowledged that children under 12 months of age should not drink fluoridated water**

Both of these statements are incorrect. The following is stated with regard to fluoridated water and infant formula preparation (and hence use of fluoridated water for children under 12 months of age) by health organizations:

Health Canada: Can I Prepare Baby Formula Using Fluoridated Water?

Yes. Infant formula prepared with water fluoridated at the optimal level of 0.7 mg/L maximizes the protective role of fluoride during the development of the permanent teeth while minimizing the risk of dental fluorosis. (1)

American Dental Association:

The panel suggested that when dentists advise parents and caregivers of infants who consume powdered or liquid concentrate infant formula as the main source of nutrition, they can suggest the continued use of powdered or liquid concentrate infant formulas reconstituted with optimally fluoridated drinking water while being cognizant of the potential risks of enamel fluorosis development. (2)

Centers for Disease Control and Prevention: Can I use optimally fluoridated tap water to mix infant formula?

Yes, you can use fluoridated water for preparing infant formula. However, if your child is exclusively consuming infant formula reconstituted with fluoridated water, there may be an increased chance for mild dental fluorosis. To lessen this chance, parents can use low-fluoride bottled water some of the time to mix infant formula; these bottled waters are labeled as de-ionized, purified, demineralized, or distilled. (3)

It should be noted that acceptable adjusted and natural fluoride levels in the United States are higher than in Canada, and therefore fluorosis levels in the United States are higher than in Canada. This may explain the slightly more conservative language in American recommendations noted above.

- (1) Health Canada: http://www.hc-sc.gc.ca/ewh-semt/water-eau/drink-potab/health-sante/faq_fluoride-fluorure-eng.php Accessed March 6, 2012
- (2) American Dental Association, The Journal of the American Dental Association January 2011 vol. 142 no. 1 79-87 <http://jada.ada.org/content/142/1/79.full#sec-18>
- (3) Centers for Disease Control and Prevention (CDC) http://www.cdc.gov/fluoridation/safety/infant_formula.htm. Accessed January 22, 2012

RESPONSE # 13 (MLHU)

- **Issue # 28 - Fluoride is genotoxic / mutagenic**

Genotoxicity or mutagenicity refers to the ability of a substance to produce effects on the genetic material of cells. The cells can be either of animal or human origin and can be exposed to the substance outside of the body (in vitro) or in the body (in vivo). The National Research

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Council report reviewed several studies on genotoxicity with respect to fluoride. The in vitro studies "are inconsistent and do not strongly indicate the presence or absence of genotoxic potential of fluoride". Regarding the in vivo studies, the report states that "the inconsistencies in the results of these in vivo studies do not enable a straightforward evaluation of fluoride's practical genotoxic potential in humans." (1)

A review of the evidence by Health Canada indicated that "The weight of evidence from all currently available studies does not support a link between exposure to fluoride in drinking water at 1.5 mg/L and any adverse health effects, including those related to cancer, immunotoxicity, reproductive/developmental toxicity, genotoxicity and/or neurotoxicity." (2)

- (1) National Research Council Report. Page 316
- (2) Health Canada, Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Fluoride. Page 1

RESPONSE # 14 (MLHU)

- **Issue # 29 - Fluoride interferes with iodine uptake**
- **Issue # 30 – Fluoride displaces iodine in the body**
- **Issue # 31 – Fluoride causes thyroid problems**
- **Issue # 32 – Fluoride causes endocrine disruption**

Iodine is important for the production of thyroid hormones, which is why iodine is added to salt. Low iodine intake leads to low thyroid function (hypothyroidism) and/or an enlargement of the thyroid gland in the neck (goitre). The possibility that fluoride may contribute to low thyroid function is explored in the US National Research Council report. (1) In this report, several animal and human studies are quoted. Some of these studies suggest an association between fluoride and abnormal thyroid function at high fluoride levels and/or when iodine levels are low. Many of the human studies were performed in developing countries where there are nutritional deficiencies not commonly seen in developed countries like Canada. Because the studies mostly involve high fluoride levels and/or low iodine levels and take place in developing countries, the findings have little relevance to London where fluoride level are low, iodine intake is adequate, and there is very different nutritional intake compared to developing countries. A review of conventional sources of medical information reveals that fluoride exposure is not discussed as a cause of hypothyroidism. (2) (3) (4) (5) (6)

- (1) National Research Council Report Pages 224-236
- (2) Kronenberg H et al., Editors. Williams Textbook of Endocrinology – 11th Edition. Saunders, Elsevier, Philadelphia, 2008
- (3) Molina P, Endocrine Physiology, Third Edition. McGraw-Hill Medical. New York. 2010
- (4) Braverman, Lewis E., Utiger, Robert D. Werner & Ingbar's The Thyroid: A Fundamental & Clinical Text (9th Edition). Lippincott Williams & Wilkins, 2005.
- (5) Up to Date. "Disorders that cause hypothyroidism".
http://www.uptodate.com.proxy2.lib.uwo.ca:2048/contents/disorders-that-cause-hypothyroidism?source=search_result&selectedTitle=4%7E150 Accessed March 26, 2011.
- (6) Fauci AS et al. Editors, Harrison's Principles of Internal Medicine – 17th Edition, McGraw-Hill Companies Inc. United States of America. 2008.

RESPONSE # 15 (MLHU)

- **Issue # 33 - Fluoride facilitates the bio-availability of aluminum and assists aluminum to cross the blood-brain barrier**

A few studies done by the same author in the 1990's in a small number of rats suggested that fluoride may increase the uptake of aluminum into the brain. (1) (2) No studies in humans are reported in either the National Research Council report or the Health Canada report to suggest any implications of this finding in humans.

- (1) National Research Council Report. Pages 216 – 218
- (2) Health Canada, Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Fluoride Page 49.

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RESPONSE # 16 (MLHU)

- **Issue # 34 - Fluoride causes brain / neurologic disorders**

Allegations of brain / neurologic disorders are based on animal studies using high doses of fluoride or unconventional methods which make them difficult to interpret and/or apply to humans. (1) (2) No human studies demonstrate an association between fluoride and dementia (such as Alzheimer's diseases). (3) Studies that suggest hydrofluorosilicic acid increases lead levels in water (which can cause neurologic problems) have also been found to lack credibility by other authors. (4)

Also see ... Response # 15, Fluoride facilitates the bio-availability of aluminum and assists aluminum to cross the blood-brain barrier, Response # 28, Fluoride causes lowered IQ, and Response #47, Fluoride increases lead levels in water by leaching lead from plumbing.

- (1) Health Canada, Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Fluoride. Page 48-50.
- (2) National Research Council Report. Pages 205–223
- (3) National Research Council Report. Pages 210-212
- (4) National Research Council Report. Page 209-210

RESPONSE # 17 (MLHU)

- **Issue # 35 – Fluoride causes diabetes**

Standard medical text books do not consider fluoride as a cause of or contributor to diabetes. (1) (2) (3) (4) (5) The Health Canada report does not contain any studies regarding an association between fluoride and diabetes. (6) The US National Research Council report references a few animal and human studies which either found no effect of fluoride on diabetes or that very high levels of fluoride may worsen diabetes. (7) There is no evidence that fluoride causes or contributes to diabetes at the levels used in London's water.

- (1) Kronenberg H et al., Editors. *Williams Textbook of Endocrinology* – 11th Edition. Saunders, Elsevier. Philadelphia, 2008
- (2) Molina P, *Endocrine Physiology*, Third Edition. McGraw-Hill Medical. New York. 2010
- (3) Up to Date. "Epidemiology, presentation, and diagnosis of type 2 diabetes mellitus in children and adolescents". http://www.uptodate.com.proxy2.lib.uwo.ca:2048/contents/epidemiology-presentation-and-diagnosis-of-type-2-diabetes-mellitus-in-children-and-adolescents?source=search_result&selectedTitle=2%7E150 Accessed March 26, 2011.
- (4) Up to Date "Epidemiology, presentation, and diagnosis of type 1 diabetes mellitus in children and adolescents". http://www.uptodate.com.proxy2.lib.uwo.ca:2048/contents/epidemiology-presentation-and-diagnosis-of-type-1-diabetes-mellitus-in-children-and-adolescents?source=search_result&selectedTitle=3%7E150 Accessed March 26, 2011.
- (5) Fauci AS et al. Editors, *Harrison's Principles of Internal Medicine* – 17th Edition, McGraw-Hill Companies Inc. United States of America. 2008.
- (6) Health Canada, Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Fluoride
- (7) National Research Council report. Pages 256-260

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RESPONSE # 18 (MLHU)

- **Issue # 36 – Fluoride causes skeletal problems**

At very high levels, fluoride can lead to skeletal fluorosis, a condition where fluoride accumulates in the bone and results in crippling calcifications in the joints, ligaments and vertebral bodies. It is a problem seen in developing countries with very high levels of natural fluoride in their water. Based on Health Canada's recent review, skeletal fluorosis is not a risk from water that has adjusted fluoride levels (such as in London), as very high levels of fluoride intake are required before skeletal fluorosis will develop. (1)

Also see.... Response # 19, Fluoride causes hip fractures

- (1) Health Canada, Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride. Page 25 - 29.

RESPONSE # 19 (MLHU)

- **Issue # 37 – Fluoride causes hip fractures**

The National Research Council review concluded that drinking water concentrations of 4 mg/L are likely to increase fracture rates compared with exposure to fluoride at 1 mg/L, particularly in some susceptible groups that are prone to accumulating fluoride into their bones (such as those with kidney problems) but no conclusions could be drawn about risk at 2 mg/L. (1)

A review was conducted in England of 29 studies that assessed the fracture risk of water fluoridated at levels closest to 1.0 mg/L compared to the lowest water fluoride level reported. The review concluded that, based on the best available evidence, fluoride was not associated with bone fractures. (2) An Australian review came to a similar conclusion, and stated "The authors of the three existing systematic review [sic] concur that water fluoridation at levels aimed at preventing dental caries has little effect on fracture risk – either protective or deleterious. (3)

- (1) National Research Council Report. Page 7.
 (2) McDonagh M, Whiting P, Bradley M et al. A Systematic Review of Water Fluoridation. 2000 NHS Centre for Reviews and Dissemination, University of York. Page 67. <http://www.york.ac.uk/inst/crd/fluorid.htm> , Accessed March 30, 2011.
 (3) National Health and Medical Research Council. A Systematic Review of the Efficacy and Safety of Fluoridation. Part A: Review of Methodology and Results. 2007. Australian Government. Page 93. <http://www.nhmrc.gov.au/publications/synopses/eh41syn.htm> Accessed March 30, 2011.

RESPONSE # 20 (MLHU)

- **Issue # 38 – Fluoride causes cancer**

Many epidemiologic studies have been conducted to evaluate the relationship between fluoride in drinking water and cancer. A number of expert committees have reviewed these studies and concluded that there is no clear association between water fluoridation and cancer. (1) (2) This includes the recent Health Canada report which states "The weight of evidence from all currently available studies does not support a link between exposure to fluoride in drinking water at 1.5 mg/L and any adverse health effects, including those related to cancer, immunotoxicity, reproductive/developmental toxicity, genotoxicity and/or neurotoxicity." (3)

At the January 25, 2012 Public Participation Meeting, the Civic Works committee was shown a video by Dr. Dean Burk based on a study conducted in the 1970s assessing cancer deaths in 20 American cities, which concluded that deaths in fluoridated cities was greater than in cities without fluoridated drinking water. (4) The National Cancer Institute reviewed this report and determined that investigations had failed to take into account the widely accepted risk factors known to affect the death rate for specific cancers. Ethnic composition of the population, geographic location, socioeconomic status, ages and sex differences had all been disregarded.

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(5) In addition, when the data from Dr. Burk's study were re-analyzed using standard procedures to account for these factors, the difference in cancer death rates was found to be due to the age and racial makeup of the respective populations. (6)

On October 12, 2011, an expert panel in California (California Proposition 65 Carcinogen Identification Committee) assessed whether fluoride should be added to a list of cancer causing agents, and based on a review of the evidence unanimously voted to not list fluoride as a carcinogen. (7)

- (1) McDonagh M, Whiting P, Bradley M et al. A Systematic Review of Water Fluoridation. 2000 NHS Centre for Reviews and Dissemination, University of York. Page 67. <http://www.york.ac.uk/inst/crd/fluorid.htm> , Accessed March 30, 2011
- (2) National Health and Medical Research Council. A Systematic Review of the Efficacy and Safety of Fluoridation. Part A: Review of Methodology and Results. 2007. Australian Government. Page 93. <http://www.nhmrc.gov.au/publications/synopses/eh41syn.htm>
- (3) Health Canada Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Fluoride. Page 1
- (4) Yiamouylannis J and Burk D. Fluoridation and cancer: age-dependence of cancer mortality related to artificial fluoridation. Fluoride 1977, 10:102-23.
- (5) Hoover RN, McKay FW and Fraumeni JR. Fluoridated drinking water and the occurrence of cancer. J Natl Cancer Inst, 1976; 57:757-768.
- (6) Doll R and Kinlen L. Fluoridation of water and cancer mortality in the U.S.A. Lancet 1977, i:1300-1303.
- (7) Consumer Health Care Products Association http://www.chpa-info.org/issues/Fluoride_.aspx ; Accessed January 22, 2012

RESPONSE # 21 (MLHU)

- **Issue # 39 – Fluoride causes osteosarcoma**

Osteosarcoma is a rare form of bone cancer. The concern about osteosarcoma in relation to fluoride arose from one animal study that found that male rats given very high doses of fluoride (100 - 175 mg/L) in their drinking water had a small increased risk of developing osteosarcoma compared to control rats. This effect was not seen in two other studies involving rats exposed to fluoride, although a study in mice showed an increase in noncancerous bone tumours at very high fluoride doses. (1)

Many human studies have been performed with regard to cancer and fluoride. Most show no risk of cancer, including osteosarcoma; however, a few suggest an association between osteosarcoma and fluoride, including a PhD research study which found an association between osteosarcoma and fluoride levels in boys, based on the fluoride levels they were exposed to at younger ages when bones were growing. (2) The National Research Council report describes this study as having "important strengths and major deficits." (3) A more recent study looked at fluoride levels in the bone adjacent to osteosarcoma and did not demonstrate an association between fluoride levels in bone and osteosarcoma. (4)

Also see.... Response # 20, Fluoride causes cancer.....

- (1) National Research Council Report. Pages 316-320; Table 10-2.
- (2) Bassin EB, Wypij D, Davis RB et al. Age-specific fluoride exposure in drinking water and osteosarcoma (United States). Cancer Causes Control. 2006;17:421-428.
- (3) National Research Council Report. Page 328.
- (4) Kim FM et al. Journal of Dental Research, October 2011; 90(10):1171-1176.

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RESPONSE # 22 (MLHU)

- **Issue # 40 - Fluoride causes decreased body weight**

Based on the National Research Council report and the review by Health Canada, a few animal studies suggested decreased body weight when animals are fed very high doses of fluoride. (1) (2) No human studies reporting this finding can be found in these reviews.

- (1) National Research Council Report. Pages 185, 319, 476
- (2) Health Canada. Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride. Pages 40, 50

RESPONSE # 23 (MLHU)

- **Issue # 41 - Fluoride causes autism**

There is no mention of an association between fluoride and autism in either the National Research Council report or the Health Canada report, two of the more recent fluoride reviews. (1) (2)

- (1) National Research Council Report.
- (2) Health Canada, Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride.

RESPONSE # 24 (MLHU)

- **Issue # 42 - Fluoride cause hyperactivity.**

There is no mention of an association between fluoride and hyperactivity in either the National Research Council report or the Health Canada report, two of the more recent fluoride reviews. (1) (2)

- (1) National Research Council Report.
- (2) Health Canada, Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride

RESPONSE # 25 (MLHU)

- **Issue # 43 - Fluoride causes learning disabilities**

There is no mention of an association between fluoride and learning disabilities in either the National Research Council report or the Health Canada report, two of the more recent fluoride reviews. (1) (2)

- (1) National Research Council Report.
- (2) Health Canada, Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride

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RESPONSE # 26 (MLHU)

- **Issue # 44 - Fluoride causes cardiovascular disease**

There is no mention of an association between fluoride and cardiovascular disease in either the National Research Council report or the Health Canada report, two of the more recent fluoride reviews. (1) (2) A recent study that discusses a diagnostic scan that uses a fluoride tracer to detect blockages in the heart (atherosclerosis) has nothing to do with fluoride as a cause of heart disease. (3)

- (1) National Research Council Report.
- (2) Health Canada. Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride
- (3) Li Y, Gholam B, Wisam S et al. Association of vascular fluoride uptake with vascular calcification and coronary artery disease. Nuclear Medicine Communications; 2012; 33(1):14-20.

RESPONSE # 27 (MLHU)

- **Issue # 45 – Fluoride causes fluorosis**

Dental fluorosis occurs during tooth development, from birth to about 5 years of age, when higher than optimal levels of fluoride are ingested. After the enamel is completely formed, dental fluorosis cannot occur. Older children and adults are, therefore, not at risk for dental fluorosis. Dental fluorosis in its questionable, very mild, and mild forms has no effect on tooth function. These types of fluorosis are not readily noticeable and often require a trained dental professional to detect.

A 2006 study of fluorosis prevalence showed that in most areas of eastern Canada, including Ontario, the prevalence of all levels of dental fluorosis is quite low. According to the findings and recommendations from the Expert Panel Meeting on fluoride recently held in Canada, from a health perspective, there is no reason to be concerned about the actual prevalence of very mild and mild dental fluorosis in Canada. (1) The Canadian Health Measures Survey, which surveyed 1,070 Canadian children aged 6 to 11 years between 2007 and 2009, found no severe fluorosis, almost no moderate fluorosis and very little mild (4%) or very mild fluorosis (12%). (2)

- (1) Health Canada (2008) Findings and recommendations of the Fluoride Expert Panel Meeting. Water, Air and Climate Change Bureau, Safe Environments Programme, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa.
- (2) Health Canada, Summary of the Oral Health Component of the Canada Health Measures Survey 2007 – 2009. Minister of Health, 2010. Summary Report Page 14 www.fptdwc.ca/English/e-documents.html , Accessed March 17, 2012.

RESPONSE # 28 (MLHU)

- **Issue # 46 – Fluoride causes lowered IQ**

Several studies have assessed IQ and fluoride levels, all from developing countries, most commonly China. (1) Studies that compare the IQ levels in rural villages are problematic because it is difficult to know if the differences in IQ are true findings or if they are related to problems with how the studies were conducted, or other unrecognized, unmeasured exposures. For example, IQ is known to be influenced by thyroid function and lead exposure. Very few of the fluoride studies assess these other exposures that may impact IQ. (2) (3)

Even if the findings of fluoride and IQ were accurate, the average fluoride levels in drinking-water in these studies were approximately three to five times higher than in London's drinking water, and the applicability of findings in rural villages in developing countries (mainly Chinese villages) to cities in developed countries is unknown. No studies looking at IQ levels in developed countries related to fluoride exposure appear to have been conducted.

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Health Canada's report stated "... the weight of evidence does not support a link between fluoride and intelligence quotient deficit, as there are significant concerns regarding the available studies, including quality, credibility, and methodological weaknesses. These conclusions are in agreement with the findings and recommendations of the 2007 Expert Panel Meeting on fluoride held in Canada (Health Canada, 2008)." (4)

- (1) National Research Council Report. Pages 205-208.
- (2) Xiang Q., Liang Y., Chen L. et al. Effects of fluoride in drinking water on children's intelligence. Fluoride 2003;36(2):84-94. As quoted in the National Research Council report, Page 205.
- (3) Xiang Q., Liang Y, Zhou M et al. Blood lead of children in Wamiao-Xinhua intelligence study (letter). Fluoride 2003;36(3):198-199. As quoted in the National Research Council report. Page 206.
- (4) Health Canada, Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride. Page 63.

RESPONSE # 29 (MLHU)

- **Issue # 47 - Fluoride damages the pineal gland**

The pineal gland is a small organ located near the centre of the brain. It produces a hormone called melatonin which is involved in the sleep-wake cycle and the onset of puberty and menopause. The National Research Council report reviewed the few studies (one animal and two human studies) that assess fluoride in relation to the pineal gland and found no evidence that fluoride damages the pineal gland and very little evidence that fluoride has any effect on the functioning of the pineal gland aside from one study in gerbils fed very high amounts of fluoride.

(1) The gerbil study is also reviewed in the Health Canada report. (2)

- (1) National Research Council Report. Page 252-256
- (2) Health Canada, Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride. Page 63.

RESPONSE # 30 (MLHU)

- **Issue # 48 - Fluoride causes birth defects**
- **Issue # 49 - Fluoride causes reproductive problems**

The most studied birth defect is Down's syndrome. A review of the literature conducted in 2001 stated that an association between water fluoride concentrations and Down's syndrome was inconclusive. (1) Overall, the National Research Council report concluded that "studies of fluoride's effects on human development are few and have some significant shortcomings in design and power, limiting their impact". (2) The reports also states "A few studies of human populations have suggested that fluoride might be associated with alterations in reproductive hormones, fertility, and Down's syndrome, but their design limitations make them of little value for risk evaluation." (3) Furthermore, Health Canada concludes that "The weight of evidence from all currently available studies does not support a link between exposure to fluoride in drinking water at 1.5 mg/L and any adverse health effects, including those related to cancer, immunotoxicity, reproductive/developmental toxicity, genotoxicity and/or neurotoxicity." (4)

- (1) Whiting P, McDonagh M and Kleijnen J. Association of Down's syndrome and water fluoride level: a systematic review of the evidence. BMC Public Health (2001)1:6.
- (2) National Research Council Report. Page 203-204.
- (3) National Research Council Report. Page 204.
- (4) Health Canada, Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride. Page 1.

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RESPONSE # 31 (MLHU)

- **Issue # 50 – Fluoride causes stomach problems**

The National Research Council report and Health Canada report both do not provide any convincing human evidence that fluoride at levels used in London cause gastrointestinal / stomach problems. These reviews indicated that gastrointestinal / stomach problems occur at significantly higher levels of fluoride exposure than would result from adjusted fluoride in London's drinking water. (1) (2)

- (1) Health Canada. Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride. Page 30.
- (2) National Research Council Report. Pages 268-274

RESPONSE # 32 (MLHU)

- **Issue # 51 - Fluoride causes unspecified health problems**
- **Issue # 52 - The City of London does not reveal the true cost of fluoridation because it does not include the costs incurred due to the health problems caused**

The safety of fluoride has been reviewed in several recent systematic reviews performed in a variety of countries including England (1), Australia (2), the United States (3) and Canada. (4) The only documented adverse effect from exposure to the low levels of fluoride used in adjusted drinking-water is dental fluorosis. In Canada, where the recommended level for adjusted fluoride is 0.7 mg/L., very little dental fluorosis occurs. The Canadian Health Measures Survey, which surveyed 1,070 Canadian children aged 6 to 11 years between 2007 and 2009, found no severe fluorosis, almost no moderate fluorosis and very little mild (4%) or very mild fluorosis (12%). (5)

- (1) McDonagh M, Whiting P, Bradley M et al. A Systematic Review of Water Fluoridation. 2000 NHS Centre for Reviews and Dissemination, University of York. Page 67. <http://www.york.ac.uk/inst/crd/fluorid.htm> , Accessed March 30, 2011
- (2) National Health and Medical Research Council. A Systematic Review of the Efficacy and Safety of Fluoridation. Part A: Review of Methodology and Results. 2007. Australian Government. Page 93. <http://www.nhmrc.gov.au/publications/synopses/eh41syn.htm>
- (3) National Research Council Report
- (4) Health Canada, Guidelines for Canadian Drinking Water Quality: Guideline Technical Document – Fluoride.
- (5) Health Canada, Summary of the Oral Health Component of the Canada Health Measures Survey 2007 – 2009. Minister of Health, 2010. Summary Report Page 14 www.fptdwc.ca/English/e-documents.html , Accessed March 17, 2012.

RESPONSE # 33 (MLHU)

- **Issue # 53 - Some children are allergic to fluoride which can cause depression**

There is no evidence in the Health Canada report or the National Research Council report that people can be allergic to fluoride or that fluoride causes depression. (1) (2) At the Public Participation Meeting on January 25, 2012, the Civic Works Committee was shown a video of a crying girl who is reported to be taking fluoride supplements and had a brain allergy to fluoride. The girl then became happier after reportedly taking a different dilution of fluoride supplements. This video clearly does not provide any convincing evidence of an association between fluoride and allergy or depression.

- (1) National Research Council Report Page 293 for allergy information
- (2) Health Canada, Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride.

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RESPONSE # 34 (MLHU)

- **Issue # 54 - Some segments of population are hyper-sensitive to fluoride**

Hyper-sensitive is a term that is generally synonymous with "allergic". There is no evidence in the Health Canada report or the National Research Council report that people can be allergic to fluoride. (1) (2)

- (1) National Research Council Report. Page 293
- (2) Health Canada. Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride.

RESPONSE # 35 (MLHU)

- **Issue # 55 - The kidneys of young children and the elderly cannot properly excrete fluoride**

There is no evidence that either the young or the elderly have difficulties excreting fluoride. The level of fluoride considered acceptable was determined based on those who are most susceptible to dental fluorosis (children 1-4 years of age). Levels of daily intake are calculated for all age groups in the Health Canada report and are near or below the tolerable daily intake for all ages at 1.0 mg/L and therefore would be below the tolerable daily intake at the 0.7 mg/L used in London. (1) These levels result in no severe fluorosis, almost no moderate fluorosis and very little mild (4%) or very mild fluorosis (12%) in Canadian children based on the Canadian Health Measures Survey. (2)

- (1) Health Canada, Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride 2010, Pages 94 and 95
- (2) Health Canada, Summary of the Oral Health Component of the Canada Health Measures Survey 2007 – 2009. Minister of Health, 2010. Summary Report Page 14 www.fptdwg.ca/English/e-documents.html, Accessed March 17, 2012.

RESPONSE # 36 (MLHU)

- **Issue # 56 - Native Americans, Latin Americans and African Americans have higher rates of diabetes and kidney disease and are therefore more susceptible to harm from fluoridated water**

There is no mention in either the Health Canada report or the National Research Council report of an increased susceptibility to harm from fluoride in Native American, Latin Americans, African Americans or Aboriginal people. (1) (2)

The relationship between diabetes and the intake of water and fluoride is discussed in Response # 6.

People with kidney problems may retain more fluoride. The National Research Council report indicates that in communities where fluoride levels in drinking water are 4.0 mg/L there may be an increased risk of fractures or other effects in people with kidney problems. (3) As this level of fluoride is more than 5 times the level in London's drinking water, fluoride levels in London are not expected to be of concern for people with kidney problems in London. Fluoridated water should not be used in dialysis equipment because of the potential to accumulate large amounts of fluoride through this process.

- (1) National Research Council Report.
- (2) Health Canada, Guidelines for Canadian Drinking Water Quality, Guideline Technical Document, Fluoride.
- (3) National Research Council Report. Pages 7 and 9

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RESPONSE # 37 (MLHU)

- **Issue # 57 - Latin Americans and African Americans have higher rates of fluorosis and are therefore more susceptible to harm from fluoridated water**

Some studies have shown that Latin Americans and African Americans have higher rates of fluorosis; however, there is no evidence to show that this is due to an increased susceptibility to the fluoride in Canadian drinking water.

The U.S. Centers for Disease Control and Prevention, Division of Oral Health has responded to this issue by stating, "[...] there is no scientific evidence that exposure to fluoride at the levels found in optimally fluoridated water present any risk for the development of any disease processes. Neither is there any evidence that certain individuals or subgroups of individuals... suffer any adverse effects from drinking fluoridated water. The preponderance of scientific evidence indicates that fluoridation of community water supplies is both safe and effective." (1)

- (1) Centers for Disease Control and Prevention, Division of Oral Health. Facts on the ATSDR Toxicological Profile for Fluorides, Hydrogen Fluoride, and Fluoride. US Department of Health and Human Services, 1998.

RESPONSE # 38 (MLHU)

- **Issue # 58 - Fluoride is absorbed through the skin during showers/baths**

Human skin serves an important role by protecting us from external factors in the environment. Each skin cell is surrounded by a protective cell membrane composed largely of fatty compounds known as lipids. These cell membranes are particularly adept at resisting penetration by water molecules and electrically-charged atoms (or ions) dissolved in water, such as fluoride ions. (1) This is why our bodies don't absorb water through our skin. It is also the reason that our bodies don't absorb salts or other ionic compounds when we swim in the ocean. Seawater, in addition to numerous other salts, has a fluoride concentration of approximately 1.3 mg/L, or about double the amount of fluoride in London tap water. (2)

A review of the primary literature found no studies on the topic of dermal (skin) absorption of fluoride from fluoridated water. Papers looking at exposure routes for fluoride primarily focus on ingestion. The major cited routes of fluoride exposure are the consumption of water, beverages and foods (including those that are processed or made with fluoridated water), and the ingestion of dental products such as fluoridated toothpaste. (3) (4)

Similarly, the Scientific Committee on Health and Environmental Risk (SCHER) found that no experimental data exists on the dermal absorption of fluoride from water. They also suggest that because fluoride is an ion, it is not expected to be absorbed through the skin when in a water solution with near neutral pH. (5)

Another possible exposure pathway when showering or bathing is inhalation. No studies on the inhalation of fluoride from showering or bathing were found. SCHER states that this exposure pathway is unlikely to contribute significantly to the body burden of fluoride in the general population (5).

- (1) Klaassen C D. Casarett & Doull's Toxicology: The Basic Science of Poisons. 7th ed. McGraw-Hill; 2008
- (2) Dobbs, G.G. 1974. Fluoride and the environment. *Fluoride* 7:123-135.
- (3) Agency for Toxic Substances & Disease Registry (ATSDR). Toxic Substances Portal – Fluorine, Hydrogen Fluoride, and Fluorides. Available from:
<http://www.atsdr.cdc.gov/toxprofiles/tp.asp?id=212&tid=38>
- (4) Erdal S, Buchanan S N. quantitative Look at Fluorosis, Fluoride Exposure, and Intake in Children Using a Health Risk Assessment Approach. *Environmental Health Perspectives*. 2005; 113(1): 111-117
- (5) Scientific Committee on Health and Environmental Risks (SCHER). Critical review of any new evidence on the hazard profile, health effects, and human exposure to fluoride and the fluoridating agents of drinking water. Brussels: European Commission, Directorate C, Public Health and Risk Assessment. 2010. Available from:
http://ec.europa.eu/health/scientific_committees/environmental_risks/docs/scher_o_139.pdf

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RESPONSE # 39 (MLHU)

- **Issue # 59 - Studies have shown that fluoridated water delays tooth eruption, so it simply delays tooth decay**

A handful of articles, the majority of which were published prior to 1977, suggested that exposure to high fluoride concentrations in drinking water delays tooth eruption (2) (3) (4) (5). Other researchers have disagreed, concluding that there was no effect of systemic fluorides on permanent tooth emergence. (6) (7) (8) In 2003, a statistically rigorous study (9) was designed to investigate this claim further. The researchers concluded that the impact of fluoride exposure was "sometimes observed, but if existing, it was minimal." (9)

- (1) Leroy et al. The effect of fluorides and caries in primary teeth on permanent tooth emergence. *Community Dent Oral Epidemiology*, 2003; 31: 463-470.
- (2) Virtanen et al. Timing of eruption of permanent teeth: standard Finnish patient documents. *Community Dent Oral Epidemiol* 1994; 22: 286-288.
- (3) Ainsworth NJ. Mottled teeth. *Br Dent J* 1933; 55: 233-50.
- (4) Feltman, Kosel. Prenatal and postnatal ingestion of fluorides – 14 years of investigation –final report. *J Dent Med* 1961;16:190-196.
- (5) Bauer et al. Eruption of permanent teeth in regions with low and high fluoride content of drinking water. *Osterr Z Stomatol* 1974; 71:122-37.
- (6) Kunzel W. Influence of water fluoridation on the eruption of permanent teeth. *Caries Res* 1976; 10:96-103.
- (7) Dean. Chronic endemic dental fluorosis. *J Am Med Assoc* 1936; 107: 1269-72.
- (8) Day M. Chronic endemic fluorosis in Northern India. *Br Dent J* 1940; 68: 409-24.
- (9) Carlos, JP et al. Longitudinal studies of the natural history of caries. Part I. Eruption patterns of the permanent teeth. *J Dent Res* 1965; 44: 509-16.

RESPONSE # 40 (MLHU)

- **Issue # 60 - Systematic reviews are not a substitute for peer-reviewed toxicological studies**

A systematic review is a research summary of all evidence that relates to a particular question, **including** relevant, peer-reviewed, toxicological studies. The question could be one of intervention effectiveness, causation, diagnosis or prognosis. The systematic review process follows a rigorous methodology for searching, retrieval, relevance and quality rating, data extraction, data synthesis and interpretation. (1) A systematic review may incorporate peer-reviewed toxicological studies if the research quality is acceptable and answers the questions being investigated.

- (1) Cullum, N., Ciliska, D., Haynes, R.B., & Marks, S. (2008). *Evidence-Based Nursing. An Introduction*. Oxford: Blackwell

RESPONSE # 41 (MLHU)

- **Issue # 61 - Cavities are not caused by a fluoride deficiency; they are caused by modern diets**

This first half of this statement is correct; dental caries is not caused by a fluoride deficiency. Caries is caused by the intersection of several factors, as illustrated in Figure 1 at the top of the next page. At the core, caries results when oral bacteria grow on teeth and use food debris left in the mouth to produce acid that degrades tooth surfaces. This process is affected by "numerous co-contributing factors, including lifestyle and human behaviour parameters." (1) Because the disease is multi-factorial, it is unlikely that changing diet alone will prevent cavities.

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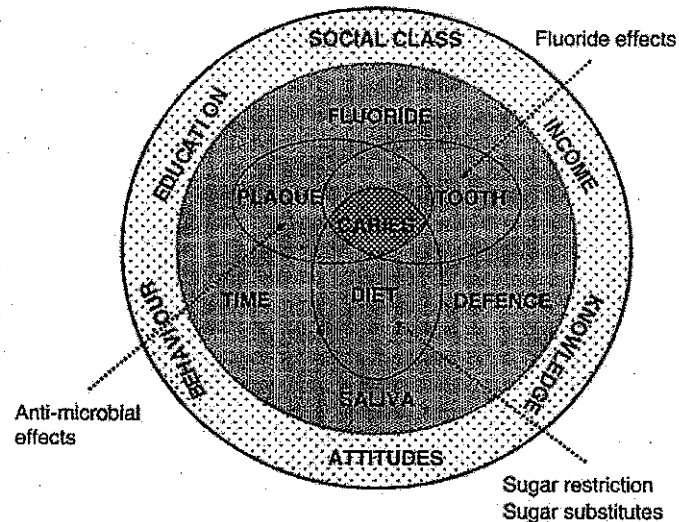


Figure 1. Modified Keyes diagram of factors determining caries development.

- (1) Cate. The need for antibacterial approaches to improve caries control. *Adv Dent Res*, 2009; 21:8-12

RESPONSE # 42 (Administration)

- **Issue # 62 – Doctors and scientists have been wrong before**

It is correct that throughout the history of scientific endeavour, incorrect conclusions have been drawn. We know this to be true because scientific methodology has revealed these errors. Such errors can be made through the neglect of accepted scientific methods, or as a result of an identifiable weakness in the accepted scientific methodology. In the case of the latter, root cause analysis is performed to identify and correct the methodological weakness so that similar errors are avoided in the future. Through this process, the scientific method constantly evolves and improves.

Current scientific methodology is our most effective tool to improve or verify our understanding of natural phenomena. It is for this reason that scientists value the process of publishing their findings in peer-reviewed academic journals. Through this process, new research is reviewed by recognized experts in the field, prior to publishing. These experts review the research methodology to ensure adherence to current scientific practices. Once published, the research findings are subject to review by the entire scientific community, who may challenge the conclusions drawn by using the same process of peer-reviewed research.

It is for these reasons that the Middlesex-London Health Unit looks to the existing peer-reviewed scientific literature when asked to evaluate a claim such as "fluoride causes autism", or "fluoride causes diabetes". If such a conclusion was published in a peer-reviewed scientific journal, this would lend substantial credence to the claim. But if such assertions are made without exposure to the peer-review process, then they cannot be considered to be supported by modern science.

In this report, Administration has recommended that Council affirm its confidence in the integrity and recommendations of the World Health Organization, Health Canada, Ontario's Chief Medical Officer of Health, and the Medical Officer of Health for the Middlesex-London Health Unit. This recommendation is based upon the understanding that these individuals and organizations are committed to making decisions and recommendations based upon current

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scientific evidence. It is important to note that a recommendation based on scientific evidence can change in the future, based on new, peer-reviewed evidence. If the agencies listed above alter their recommendation in the future with respect to drinking-water fluoridation, Administration will provide that information to Council, so that the best evidence-based decisions can be made.

RESPONSE # 43 (MLHU)

- **Issue # 63 - The York review concluded that water fluoridation is not safe nor could be concluded to be cost-effective**

The York review is a comprehensive systematic review conducted by the University of York in the United Kingdom: it was published in 2000. The aim of the York Review was to assess the evidence on the positive and negative effects of population wide drinking water fluoridation strategies to prevent caries. To achieve this aim, five objectives were identified:

- **Objective 1:** What are the effects of fluoridation of drinking water supplies on the incidence of caries?
- **Objective 2:** If water fluoridation is shown to have beneficial effects, what is the effect over and above that offered by the use of alternative interventions and strategies?
- **Objective 3:** Does water fluoridation result in a reduction of caries across social groups and between geographical locations, bringing equity?
- **Objective 4:** Does water fluoridation have negative effects?
- **Objective 5:** Are there differences in the effects of natural and artificial water fluoridation?

1. The York Review was not asked to determine if water fluoridation was cost effective.
2. The York Review did review potential adverse health effects. The review concluded that dental fluorosis may be present and cause an "aesthetic concern". There was no clear association between bone fracture/developmental problems and water fluoridation. Also, no clear association between water fluoridation and incidence or mortality of bone cancers, thyroid cancer or all cancers was found. However, the studies examining other possible adverse effects provided insufficient evidence regarding any particular outcome to permit confident conclusions. Further research in these areas needs to be of a much higher quality and should address and use appropriate methods to control for confounding variables. (1)

It should be noted that the York review was published in 2000, and there have been other, more recent, reviews that have examined new research.

(1) Center for Reviews and Disseminations. *Fluoridation of Drinking Water: A Systematic Review of its Efficacy and Safety*. York, UK: University of York, 2000.

RESPONSE # 44 (Administration)

- **Issue # 64 - Toothpaste tubes contain a warning to call poison control if you swallow it - therefore fluoride is toxic**

The question of whether a substance is toxic, or not, is dependent upon the dosage of the substance ingested. It is a well known principle of biology that beneficial effects can result from exposure to low doses of a substance, whereas the same substance can be toxic when given at higher doses. For example, the air that we breathe is comprised of about 20% oxygen; but oxygen is toxic to humans at high concentrations. Another example is vitamin and mineral supplements; though vitamins and minerals are essential to human life, high doses can be toxic or fatal. It is not uncommon for unattended children to over-consume vitamin supplements, and it is important to seek medical attention if this occurs.

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Very high doses of fluoride should also be avoided. Some children will eat toothpaste straight from the tube; in the U.S., toothpaste tubes contain a warning that if more than the amount used for brushing is swallowed, then Poison Control should be called to provide guidance. This warning is not found on toothpaste tubes in Canada.

If a Poison Control centre is contacted regarding the ingestion of toothpaste, they will ask about the amount of toothpaste consumed, e.g. a small squirt, or an entire tube. The guidance provided by the Poison Control centre depends upon this information. Administration contacted the Vice-President of the Canadian Association of Poison Control Centres and asked how they would advise someone who called to report that a child had eaten toothpaste. The following response was provided:

"It is the mandate of every poison centre to offer treatment advice in the event of exposure to fluoride in its many different forms. This an example of one of the guidelines used at one of our Canadian Poison Centres;

Acute Ingestion:

Ingestion of dental products in children may cause mild stomach upset. Systemic toxicity is rare.

Toxic dose:

Self-limiting gastrointestinal symptoms may occur following ingestion of up to 8 mg/kg (mg of fluoride per kg of body weight) of elemental fluoride in dental products. Ingestion of ≥ 8 mg/kg elemental fluoride may result in systemic symptoms.

In essence it would usually take a large amount of toothpaste to cause acute toxicity in a child.

As you are aware, at the current recommended fluoridation levels of 0.7 mg/L in Canadian water, 8 mg/kg works out to be 11.4 L of water per kg of body weight.

Regarding the U.S. labelling requirement to call a Poison Control center, the US Code of Federal Regulations requires generic warnings on labels for all over-the-counter drugs "which are generally recognised as safe and effective..." The fluoride label is a variant of this generic warning; of course, the general warnings are not a gauge of inherent danger or toxicity."

RESPONSE # 45 (Administration)

- Issue #65 – The Hazardous Waste Act does not permit HFSA to be added to the environment, yet we return our tap water to the Thames River
- Issue # 66 – Since it is illegal to dump HFSA in the environment, why is it okay to add it to drinking water?
- Issue # 67 – It is illegal to discharge fluoridated water to the environment
- Issue # 68 – Environment Canada has a Fluoride Guideline of 0.12 mg/L for water discharged to the environment
- Issue # 69 – Fluoride in our water causes unspecified "harm to the environment"

There is no "Hazardous Waste Act" in Canada, and HFSA is not defined as a hazardous waste by Canadian legislation, such as the Canadian Environmental Protection Act, 1999. HFSA is a product that the City of London purchases and uses for a specific purpose; as such, it does not meet the definition of a waste product.

The HFSA that London purchases is a concentrated acid that is diluted in an approximate ratio of 1:450,000 in our drinking-water. In its concentrated state, it is a corrosive acid, and it would certainly be illegal to discharge it to the environment. However, as stated earlier, when the HFSA is diluted into drinking-water, the HFSA molecules become completely dissociated; that is, by interacting with water molecules, the ions (predominantly fluoride) that make up the HFSA separate from each other and disperse into the water. Because of this dissociation, the HFSA that is added to the water actually ceases to exist as HFSA. People do not ingest, and are not exposed to HFSA when they drink fluoridated water. Similarly, no HFSA exists in the tap water that we return to the environment.

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The Thames River, the Great Lakes, and all natural water sources contain fluoride ions. Although fluoride ions are always present in natural water sources, very high levels of fluoride can be harmful to the aquatic environment. In 1999, the Canadian Council of Ministers of the Environment (CCME) established an Interim Guideline (1) for total inorganic fluorides of 0.12 mg/L. Interim Guidelines are defined as follows:

"interim guideline: For sediment, water, and tissue residue guidelines: a guideline value derived from a data set that has met a lesser CCME requirement than that of a full guideline. Once data gaps are addressed by the scientific community, a full guideline may be derived."

As of 2012, a full guideline has not been derived.

In Ontario, the MOE regulates discharges to the environment, and London's wastewater treatment plants must meet the MOE's Provincial Water Quality Objectives, which are established to ensure that the water quality is satisfactory for aquatic life and recreation. There is no Ontario Provincial Water Quality Objective for fluoride.

The province of British Columbia however, has established "Ambient Water Quality Criteria for Fluoride". (2) The overview report that established BC's fluoride criteria notes that *"The main sources of fluoride contamination in BC are the Alcan aluminum smelter in Kitimat and the Cominco fertilizer plants in Trail and Kimberley"* The report also notes that *"Most fish are much less sensitive to fluoride than are trout or salmon"*, and that the fluoride criteria *"is designed for soft, coastal waters where Oncorhynchus species (Pacific Salmon and Trout) reproduce"*.

The BC criteria states that *"The total fluoride concentration of fresh waters should not exceed 0.4 mg/L when hardness is 10 mg/L, otherwise use the equation: $LC_{50} \text{ fluoride} = -51.73 + 92.57 \text{ Log}_{10}(\text{Hardness})$ and multiply by 0.01"*. In other words, for very soft water any discharges must not raise the total fluoride concentration of the natural water above 0.4 mg/L. Since water hardness negates the effects of fluoride ions, they provide a formula to calculate the criteria for harder water.

London's drinking water is fluoridated to a target value of 0.7 mg/L. When water goes down our drains, it mixes and dilutes with the groundwater that also enters our sanitary sewer system. City staff have measured the fluoride content of the effluent water at the Greenway Pollution Control Plant before it is discharged to the Thames River, and found the average fluoride content to be 0.37 mg/L. So, even before this water is greatly diluted by the Thames itself, the fluoride content is below the stringent 0.4 mg/L BC criteria for very soft water.

However, the water in the Thames River is not "very soft water"; it's very hard, generally between 200 and 300 mg/L by Ministry of Environment (MOE) measurement. Using an average hardness of 250 mg/L, the BC formula provides a criteria value of 1.7 mg/L. That is, the BC criteria that was designed to protect the highly sensitive Pacific Salmon and Trout, would allow for a fluoride concentration in the Thames water of 1.7 mg/L; a value that is much higher than could result from the discharge of fluoridated drinking-water. Again, the BC criteria were designed to regulate industrial waste discharges to natural waterways.

In 2004, a paper titled "Water Fluoridation and the Environment: Current Perspective in the United States" was published in The International Journal of Occupational and Environmental Health. (3) In the paper, *"Evidence of water fluoridation's effects on plants, animals, and humans is considered based on reviews by scientific groups and individual communities"*. The following is reproduced from the paper's conclusions:

"There appears to be no concern about the environmental aspects of water fluoridation among those experts who have investigated the matter."

In 2011, the European Commission's Scientific Committee on Health and Environmental Risks (SCHER) published a report titled *"Critical review of any new evidence on the hazard profile, health effects, and human exposure to fluoride and the fluoridating agents of drinking water"*. (4)

Among the conclusions of the SCHER report is the following:

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"Based on three lines of evidence, a simplistic risk assessment, mass balance modelling and a modified EUSES analysis, SCHER is of the opinion that adding fluoride to drinking water at concentrations between 0.8 mg F-/L and the reference dose level of WHO (1.5 mg F-/L) does not result in unacceptable risk to water organisms."

It should be noted that the City of London fluoridates to a concentration of 0.7 mg/L, which is lower than the range of fluoride concentrations that SCHER evaluated.

- (1) Canadian Council of Ministers of the Environment. 2002. Canadian water quality guidelines for the protection of aquatic life: Inorganic fluorides. In: Canadian environmental quality guidelines, 1999, Canadian Council of Ministers of the Environment, Winnipeg.
- (2) <http://www.env.gov.bc.ca/wat/wq/BCguidelines/fluoride/fluoridetoo-04.html>
- (3) Pollick, H. Water Fluoridation and the Environment: Current Perspective in the United States. INT J OCCUP ENVIRON HEALTH 2004;10:343-350
- (4) Scientific Committee on Health and Environmental Risks (SCHER). Critical review of any new evidence on the hazard profile, health effects, and human exposure to fluoride and the fluoridating agents of drinking water. May, 2011.

RESPONSE # 46 (Administration/MLHU)

- **Issue # 70 - Discontinuation of fluoridation would save taxpayers money**

Administration has estimated that that the fluoridation of London's water costs approximately \$133,000 per year, or about 38 cents per London resident per year. As noted earlier in this report, on February 17, 2011, the Board of Health for the Middlesex-London Health Unit (MLHU) received a staff report recommending that the Board of Health "...support the ongoing fluoridation of the City of London's drinking water supply as a measure to achieve optimal dental/oral health for all residents, which is an important component of total health." (reproduced as Appendix 'C'). The MLHU report reviewed the history of water fluoridation and current practices in the City of London, and discussed the safety and effectiveness of water fluoridation. The report noted estimates that for every \$1 invested in community water fluoridation, \$38 in dental treatment costs are avoided.

RESPONSE # 47 (Administration)

- **Issue # 71 - Fluoride increases lead levels in water by leaching lead from plumbing**

In 2000, U.S. E.P.A. researchers concluded that there is no "credible evidence" that water fluoridation has any quantifiable effect on the solubility, bioavailability or bioaccumulation of any kind of lead. (1)

Lead is released into water due to the corrosion of lead pipes and lead-containing plumbing materials, such as brass and solder. In 2004, a paper titled "Water Fluoridation and the Environment: Current Perspective in the United States" was published in The International Journal of Occupational and Environmental Health. (2) In the paper, the issue of fluoride and lead release is addressed as follows: "According to the U.S. Environmental Protection Agency and the National Association of Corrosion Engineers, corrosion is not related to fluoride. Corrosion by potable water is primarily caused by dissolved oxygen, pH, water temperature, alkalinity, hardness, salt, hydrogen sulfide, and certain bacteria. Fluoride, at concentrations found in potable water, does not cause corrosion. A small increase in the corrosivity of potable water that is already corrosive may occur after treatment with alum, chlorine, fluorosilicic acid, or sodium silicofluoride, which decreases pH. This may occur in some potable water sources with little buffering capacity; it can easily be resolved by adjusting the pH upward."

It should be noted that the pH of the City of London water is upwardly adjusted to minimize lead corrosion.

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In 2011, the European Commission's Scientific Committee on Health and Environmental Risks (SCHER) published a report titled "Critical review of any new evidence on the hazard profile, health effects, and human exposure to fluoride and the fluoridating agents of drinking water". (3)

The SCHER report states that: "It has been claimed that fluoridated drinking water increases human exposure to lead due to solubilisation of lead from drinking water pipes by formation of highly soluble lead complexes. The claim was based on relationships of drinking water fluoridation and blood lead concentrations observed in a case study (Coplan et al. 2007). Based on the available chemistry of fluoride in solution, the chemistry of lead and lead ions, and the concentrations of fluoride in tap water, it is highly unlikely that there would be an increased release of lead from pipes due to hexafluorosilicic acid" (also known as hydrofluorosilicic acid).

- (1) Urbansky ET, Schock MR. Can fluoridation affect lead(II) in potable water? Hexafluorosilicate and fluoride equilibria in aqueous solution. *Int J Environ Stud* 2000;57:597-637.
- (2) Pollick, H. Water Fluoridation and the Environment: Current Perspective in the United States. *INT J OCCUP ENVIRON HEALTH* 2004;10:343-350
- (3) Scientific Committee on Health and Environmental Risks (SCHER). Critical review of any new evidence on the hazard profile, health effects, and human exposure to fluoride and the fluoridating agents of drinking water. May, 2011.

RESPONSE # 48 (Administration/MLHU)

- **Issue # 72 - Other Canadian cities have stopped fluoridating, so London should as well**

It is correct that some Canadian municipalities have recently decided to stop fluoridating their water, such as Calgary, AB, Moncton, NB, and Waterloo ON. It is also correct that in other Canadian municipalities the decision has recently been made to re-affirm their support for water fluoridation, such as Cape Breton Nova Scotia, and the Ontario municipalities of the Region of Halton, the Region of Peel, Toronto, Hamilton, Sarnia, Norfolk, Atikokan and Tottenham.

As reported earlier, community water fluoridation in Dorval, QC was discontinued in 2003. In the 2-year period that followed, the percentage of kindergarten children at high risk of developing dental cavities doubled: rising from 8% to 17%. (1) In 2008, drinking-water fluoridation was re-introduced in Dorval.

In each of the decisions listed above, different local factors applied in each municipality; but in each case listed above, local, provincial and federal public health agencies expressed their support for drinking-water fluoridation.

- (1) Levy, M. Update on Water Fluoridation in Quebec (French) from INSPQ Water fluoridation: An analysis of the health benefits and risk. 2007. 9e Quebec Public Health Meeting.

RESPONSE # 49 (MLHU)

- **Issue # 73 - There are other jurisdictions in Canada and around the world that do not fluoridate their water, so London shouldn't either**

The claim that fluoridation has been banned in other countries has been used often by opponents of fluoride. There are a number of countries that do not fluoridate their water supplies; however, this should not be misconstrued as concern over safety or effectiveness. Inaction is not synonymous with banning; some countries have simply not implemented a fluoridation system for a variety of technical, legal, financial or political reasons. (1)

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To illustrate:

1. France has not implemented communal water fluoridation due to distribution difficulties, but has implemented the fluoridation of milk and salt; in addition, approximately one million people in France drink water with a natural fluoride content of 0.7 ppm or more.
2. Although fluoridation is not practiced in Sweden and the Netherlands, both countries support the World Health Organization's (WHO) recommendations regarding fluoridation as a preventive health measure.
3. Switzerland, Germany, Mexico, Jamaica and Costa Rica receive benefits from salt fluoridation (1). In many parts of the world, fluoridation is not feasible for several reasons; lack of a central water supply, the presence of more urgent health needs and lack of sufficient funds for startup and maintenance costs (1).

Political decisions contrary to the recommendations of health authorities should not be interpreted as a negative response to water fluoridation; other factors affect political decisions.

Universal access to preventive dental treatment is not yet available in Ontario or Canada; therefore, we rely on community water fluoridation to aid in the prevention of dental decay.

(1) American Dental Association. *Fluoridation Facts*. Printed in US: 2005.

RESPONSE # 50 (Administration)

- **Issue # 74 - Fluoride is found in rat and cockroach poison**

Fluoride is the naturally occurring form of the element fluorine. The elements of the periodic table are the fundamental building blocks of all substances, much like the letters of the alphabet are the fundamental building blocks of all words. Just as different combinations of letters form different words, different combinations of elements form different substances. If a particular element is found within a particular substance, this does not imply that other substances containing that same element share all the characteristics of the first substance.

For example, the most common rat poisons are a family of anti-coagulant chemicals known as 4-Hydroxycoumarins. These chemicals are composed of the elements carbon, hydrogen and oxygen. The number of atoms of each constituent element, and the unique bonding and orientation of these elements, give the chemical its unique characteristics. It should not be deduced that carbon, hydrogen or oxygen should be avoided because they are found in rat poison.

RESPONSE # 51 (Administration)

- **Issue # 75 - The Material Safety Data Sheet for HFSA is missing key pieces of information, and states that HFSA is a carcinogen**

The Workplace Hazardous Materials Information System (WHMIS) is Canada's national hazard communication standard. The key elements of the system are cautionary labelling of containers of WHMIS "controlled products", the provision of material safety data sheets (MSDSs) and worker education and training programs. MSDSs are readily obtainable from many sources.

At the January 25, 2012 Public Participation Meeting, one presenter provided slides which were identified as being reproduced from an MSDS for HFSA. The slide that was presented indicated that HFSA is listed as a "Group 3 Carcinogen", and in several other categories the required information was listed as "Not Available". However, there were several discrepancies between what was presented as being an HFSA MSDS, and the actual MSDS that is provided by the supplier of London's HFSA. These discrepancies are illustrated in the table below.

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MSDS Category	Jan 25/12 Slide Presentation	Actual MSDS for HFSA
Carcinogenicity Data	IARC group 3 Carcinogen (listed as **undefined**)	The ingredient(s) of this product is (are) not classed as carcinogenic by ACGIH, IARC, OSHA or NTP. See "Other Studies Relevant to Material".
Respiratory / Skin Sensitization	Not Available	None known
Synergistic Materials	Not Available	None known
Reproductive Data	Not Available	No adverse reproductive effects are anticipated
Teratogenicity Data	Not Available	No adverse teratogenic effects are anticipated
Mutagenicity Data	Not Available	No adverse mutagenic effects are anticipated

It should be noted that the information listed on the MSDS for HFSA applies to HFSA in its concentrated form. This information is provided in the event that workers are accidentally exposed to concentrated HFSA, or if concentrated HFSA is accidentally released to the environment.

As has been noted previously in this report, when the HFSA is diluted into drinking-water, the HFSA molecules become completely dissociated; that is, by interacting with water molecules, the ions (predominantly fluoride) that make up the HFSA separate from each other and disperse into the water. Because of this dissociation, the HFSA that is added to the water actually ceases to exist as HFSA, and the information on the MSDS ceases to apply.

People do not ingest, and are not exposed to HFSA when they drink fluoridated water. Similarly, no HFSA exists in the tap water that we return to the environment.

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Appendix 'F'

Detailed Cost Calculations for the Three Alternatives Models of Fluoride Delivery
that were Presented in Appendix E, Response # 2

Table A: Option 1: Topical Fluoride Applied in Public Health Unit-run Clinics		
	Unit Cost	Program Cost
Program Cost		
Population Size	152,789	
Number of Clinics	15	
Topical Fluoride	\$2.37	
Number of Application of Topical Fluoride per Year	2	
Topical Fluoride Cost	\$4.74	\$724,217.58
Clinic Staff	60	
30 Dental Assistants	\$44,292.00	\$1,328,760.00
30 Dental Hygienists	\$56,389.00	\$1,691,670.00
Clinic Staff Benefits (20%)		\$604,086.00
Clinic Operating Cost	\$20,000.00	\$300,000.00
Administrative Staff Salary	\$44,292.00	
Administrative Staff Benefits (20%)	\$8,858.40	
Administrative Staff	3	\$159,451.20
Administrative Office Expenses		\$9,450.00
Total Program Costs		\$4,817,634.78
One-time Costs		
Administrative Office Setup		\$15,000.00
Advertising Campaign	See Table D	\$117,000.00
Database		\$130,000.00
Capital (clinic setup costs)	\$50,000.00	\$750,000.00
TOTAL ONE-TIME COSTS		\$1,012,000.00

Table B: Option 2: Topical Fluoride by Dental Professionals in Private Clinics		
	Unit Cost	Program Cost
Program Cost		
Population Size	152,789	
Visits per Year	2	
Fluoride and Application (twice per year)	\$47.50	\$14,514,909.40
Administrative Staff Salary	\$44,292.00	
Administrative Staff Benefits (20%)	\$8,858.40	
Administrative Staff	3	\$159,451.20
Administrative Office Expenses		\$9,450.00
Total Program Costs		\$14,683,810.60
One-time Costs		
Administrative Office Setup		\$15,000.00
Advertising Campaign	See Table D	\$117,000.00
Database		\$130,000.00
TOTAL ONE-TIME COSTS		\$262,000.00

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Table C: Option 3: Mail Out Program		
	Unit Cost	Program Cost
Program Cost		
City of London Population	378,809	
Toothbrushes (every 3 months)	\$0.31	\$469,723.16
Toothpaste (every 3 months)	\$2.00	\$3,030,472.00
Distribution	\$0.20	\$29,105.00
Inserts	\$0.20	\$29,105.00
Stuffing	\$0.10	\$14,552.50
Administrative Staff Salary	\$44,292.00	
Administrative Staff Benefits (20%)	\$8,858.40	
Administrative Staff	3	\$159,451.20
Travel		\$5,000.00
Administrative Office Expenses		\$9,450.00
Total Program Costs		\$3,746,858.86
One-time Costs		
Administrative Office Setup		\$15,000.00
Advertising Campaign	See Table D	\$117,000.00
TOTAL ONE-TIME COSTS		\$132,000.00

Table D: Advertising Campaign	
Market Research	\$20,000
Brochure Mail-Out	\$60,000
Print	\$2,000
Radio	\$5,000
Television	\$5,000
Production Costs	\$15,000
Evaluation Costs	\$10,000
Total Advertising Cost	\$117,000