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TO:	CHAIR AND MEMBERS CIVIC WORKS COMMITTEE MEETING ON JANUARY 25, 2012
FROM:	JOHN BRAAM, P.ENG. DIRECTOR OF WATER AND CITY ENGINEER
SUBJECT:	DRINKING WATER FLUORIDATION IN LONDON

RECOMMENDATION

That, on the recommendation of the Director of Water and City Engineer, Municipal Council **APPROVE** a resolution stating the following:

WHEREAS the City of London's drinking water has been fluoridated since September of 1967;

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;

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

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;

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, 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"*;

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"*;

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"*;

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, Environment and Transportation Committee, Agenda Item #2

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 fluoride due to the rocks and minerals that the water contacts. 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 quite abundant in Florida, the source of London's fluoride. These rocks are rich in 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 ensure that each shipment of hydrofluorosilicic acid received 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 material that was recently evaluated by Health Canada over a 3-½ year period, 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.

Acknowledgements

This report has been prepared with input from Roland Welker, Division Manager, Water Engineering and Dan Huggins, Water Quality Manager.

SUBMITTED BY:	RECOMMENDED BY:
JOHN SIMON, P.ENG. DIVISION MANAGER, WATER OPERATIONS	JOHN BRAAM, P.ENG. DIRECTOR OF WATER AND CITY ENGINEER
REVIEWED & CONCURRED BY:	
PAT MCNALLY, P.ENG. EXECUTIVE DIRECTOR, PLANNING, ENVIRONMENTAL AND ENGINEERING SERVICES	

- c.c. Jeff Fielding – City Manager
- Cathy Saunders – City Clerk
- Roland Welker – Division Manager – Water Engineering
- Andrew Henry – Division Manager – Regional Water Supply
- Dan Huggins, Water Quality Manager
- Dr. Graham Pollett – Medical Officer of Health – Middlesex-London Health Unit
- Dr. Bryna Warshawsky – Associate Medical Officer of Health – Middlesex-London Health Unit

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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.

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

Appendices available upon request