To: Mayor and Members
   Board of Health

From: Elizabeth Richardson, MD, MHSc,
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      Public Health Services

Date: October 12, 2007

Re: Water Fluoridation BOH07057 (City Wide)

Council Direction:

At its meeting of April 23, 2007, the Board of Health, in considering correspondence
from Middlesex-London Board of Health recommending the establishment of an Ontario
Office of Fluoridation, asked staff to report back on adding fluoride to drinking water and
concerns expressed in a document submitted by Councillor McCarthy.

Information:

Fluoridation of drinking water was widely introduced across North America in the mid-
1900s, and resulted in significant decreases in dental decay. The practice of water
fluoridation continues to be strongly endorsed by the Centres for Disease Control as well
as the World Health Organization and the Canadian Medical and Dental Associations.

A number of concerns have been raised about water fluoridation. A number of
systematic reviews have examined these issues and continue to recommend water
fluoridation. All recommend that the weight of high quality scientific evidence does not
support an association between fluoridation and any adverse health effect, including
cancer. Research in this area is ongoing.

The overall benefit of water fluoridation is smaller today than it was in the past, in part
due to general improvements in health, and due to increasing availability of topical
fluoride through toothpaste and preventive dental care. At this time, the greatest burden
of dental caries remains among those of lower socioeconomic class, and is largely of the
type that cannot be prevented by water fluoridation (pit and fissure decay). Improved
access to preventive dental care could further improve oral health. The CDC
recommends school-based or school-linked pit and fissure sealant programs be implemented in addition to fluoridation.¹

The decision about whether to fluoridate drinking water rests at the local level. Each municipality that operates a drinking water supply has the authority under the Ontario Fluoridation Act, RSO 1990 to pass a by-law commencing or stopping fluoridation. Councils may use a public referendum to make this decision. Within Hamilton's governance structure, decisions about water fluoridation would be in Council's perview, through the Public Works Committee. In those communities that have stopped fluoridation, the incidence of decay usually rises. The provision of alternative free, comprehensive dental programs appears to be able to offset the effects of stopping water fluoridation.

If Hamilton were to choose to discontinue water fluoridation, it would be essential to have in place other measures to avoid increases in dental decay. Such measures would need to include, at a minimum, topical application of fluoride for school children and a communication campaign to ensure Hamiltonians and dental and medical professionals are aware of the status of drinking water in Hamilton. Careful consideration would be needed of available evidence regarding alternative approaches, and consultation to establish the approach most likely to be successful in Hamilton. Financial and staffing implications would be significant. Further, it would be important to thoroughly study the effect of discontinuing fluoridation, both to understand the local impact and to contribute high quality science to inform further reviews.

**Background:**

Fluoride is a naturally occurring substance in ground water. Generally, surface water sources such as lakes, rivers and streams have lower concentrations of fluoride. The naturally occurring level of fluoride in Lake Ontario, the major source of Hamilton’s drinking water, is 0.15 p.p.m.

Scientific studies in the 1920s and 1930s discovered that people who lived in communities with water with moderate levels of fluoride had less dental decay than those in communities with low levels of natural fluoride. In 1940, four community wide studies were conducted to examine the effect on dental health of adding sodium fluoride to fluoride deficient water supplies. The studies were conducted in Grand Rapids, Michigan, Newburgh, New York, Brantford, Ontario and Evanston, Illinois. These studies found that fluoridation was a practical and safe public health measure to prevent tooth decay. It is estimated that today over 405 million people worldwide are the beneficiaries of water fluoridation. In Ontario, 70 % of the population, or about 8.7 million people, receive fluoridated drinking water. Hamilton’s drinking water has been fluoridated since the community voted in favour of fluoridation in 1966.

**How Fluoride Works**

Fluoride works to prevent tooth decay by increasing the resistance of tooth enamel to the acids that cause tooth decay. During the formation of teeth, fluoride that is ingested

becomes incorporated into the tooth structures and is deposited throughout the entire tooth surface, providing long-lasting protection against tooth decay. This is the major way fluoridated water works.

Topical fluorides are applied after the teeth are already present in the mouth and are incorporated into the surface of the teeth. Topical fluorides are more effective than ingested fluoride. The major sources of topical fluoride are toothpaste and professionally applied fluoride foams, gels and varnishes. Fluoridated drinking water also provides some topical benefits.

**Adverse Effects of Fluoride**

While exposure to the low levels of fluoride used in water fluoridation has beneficial effects for teeth, like many vitamins and minerals, exposure to too much fluoride can cause adverse health effects. Various effects of fluoride on health have been studied including impacts on blood, bone, kidney, liver, lungs and reproduction. Concern has also been expressed about the possible carcinogenic effect of fluoride. The overall assessment of the scientific evidence is that fluoride exposures at levels optimal for oral health are not a likely cause of cancer or other adverse health effects. Research in this area is ongoing.

Of all the potential adverse effects, dental and skeletal fluorosis - impact on teeth and bone structure – are the most well documented. These effects are most common in areas where natural levels of fluoride in water are very high and in excess of the concentrations used for fluoridated drinking water. Dental fluorosis is a change in the appearance of teeth caused when higher than optimal amounts of fluoride are ingested in early childhood during the time that the teeth are forming. In its mild form, dental fluorosis appears as white flecks on the tooth surface. In the more severe forms, brown staining and/or pitting occur on the tooth surface. Dental fluorosis is most often mild and primarily a cosmetic concern. Dental fluorosis can affect people who live in communities with or without fluoride in their water supply.

The level of fluoride in Hamilton’s water ranges between 0.5 and 0.8 ppm, in keeping with provincial guidelines. The Ontario Ministry of the Environment’s (MOE) maximum allowable concentration for fluoride in drinking water is 1.5 ppm. However, the MOE recommends a slightly lower level for adding fluoride to water to address concerns about the number of children exhibiting the mild form of fluorosis. Fluoride levels in drinking water are monitored regularly by Public Works and Public Health Services to ensure recommended levels are not exceeded.

Concerns have been raised about whether the number and magnitude of sources of fluoride today lead to excessive exposures to fluoride. Health Canada’s tolerable daily dose for fluoride is 0.122 mg/kg/day based on protecting against moderate dental fluorosis. The US EPA has established that no adverse impacts would be found at a reference dose of 0.06 mg/kg/day. Toronto Public Health in its review of fluoridation found that exposures to fluoride from all sources (air, soil, food, toothpaste, drinking water, infant formula and breast milk) for toddlers, formula and breast fed infants are 0.07, 0.04 and 0.01 mg/kg/day respectively.²

A discussion of the impact, if any, of fluoridation of drinking water on the natural environment was considered outside the scope of this report. If desired, information on that topic could be provided by Public Works and Public Health Services in a future report.

**What are the Benefits of Community Water Fluoridation?**

A large body of credible scientific evidence world-wide attests to the fact that fluoridation of community water supplies is safe and effective in preventing dental decay in children and adolescents. However, over the years, there has been an apparent decrease in the level of benefit conferred; this decrease is likely related to the exposure to fluoride from sources other than drinking water. Fluoride has become more widely available through fluoridated toothpastes and professional care. In addition, fluoridated water used in food and beverage preparation leads to the so-called “halo-effect” where those goods produced in communities with fluoridated water, such as reconstituted fruit juices, pop, etc., are consumed in non-fluoridated communities who then receive the benefits of water fluoridation. In this way fluoridation is much like immunization: if all water fluoridation was to cease, then this route for fluorides’ benefit would also disappear. One area of impact that has not been well-studied is the relationship between water fluoridation and adult oral health benefits.

The question arises as to whether water fluoridation is still necessary given these additional sources. Studies to date show that water fluoridation still has beneficial effects despite the availability of fluoride through these other routes. It is also postulated that fluoridated water is more accessible to those with lower incomes, while toothpaste and preventive dental care may not be available to all. A British systematic review found that this may be the case, but suggested caution given the quality of available studies.3

**What Happens If Fluoridation is stopped?**

There are several studies that report no increase in dental decay following the discontinuance of fluoridation. However, in most cases, other preventive measures were introduced at the time that water fluoridation was discontinued. For example in a Cuban community, the rate of dental decay did not increase after water fluoridation was stopped. However when fluoridation was stopped, children received regular fluoride mouth rinses, and fluoride varnish was placed on teeth in a comprehensive school preventive dental program.

Similarly a longitudinal study in Finland showed little difference in decay rates between fluoridated and communities with low levels of natural fluoride. However, Finland has a government–sponsored free, comprehensive dental program in which children receive a regimented, professionally supervised preventive dental program of topical fluorides and dental sealants. In East Germany, when water fluoridation was discontinued, salt fluoridation and other preventive measures were introduced and there was no significant increase in dental decay.4

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4 Toronto Public Health Staff Report.
A specific process under the *Fluoride Act* allows opponents of water fluoridation to have their concerns addressed through a mechanism that ensures a majority of support by voters.

If Hamilton were to stop fluoridation, the evidence underscores the importance of an accessible, comprehensive, preventive and treatment dental program for all Hamilton children to reduce the likelihood that the oral health of Hamilton’s population will deteriorate. If dental decay rates were to increase, there would be an increase in utilization of both 100% municipally funded and cost-shared dental programs through CINOT (Children In Need Of Treatment) and Ontario Works. There would also be increased costs related to communication campaigns and monitoring of dental status. The existing fluoridation system is past its useful life and Public Works has an upgrade project in their capital budget which will be started in 2008. Any cost savings from within the Public Works’ programs would be returned to the ratepayer or applied towards other improvements of the water system as per the sustainable Water and Sewage Act.

**Providing High Quality Information for Decision-Making**

Given the widespread use of water fluoridation, and concerns that are raised from time to time about its use, ongoing high quality research on the effects and effectiveness of fluoridation are needed. The Middlesex-London Board of health has passed a resolution calling for the establishment of an Ontario Fluoridation Office to constantly assemble and review current scientific evidence on fluorides and water fluoridation, and evaluate Ontario data for evidence of the effectiveness of water fluoridation (see appendix A). Ontario public health dentists also recommend the establishment of an Ontario Fluoridation Office by the provincial government. Calls for further high quality research were also made in a British systematic review.\(^5\)

This Office would result in the best advice to Ontarians regarding water fluoridation, with consideration of any new evidence that may become available in upcoming years. If agreed to by the provincial government, such an office would likely take a number of years to become established. Public health staff will continue to monitor research in this area and review reports of the levels of fluoride in the City water supply.

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\(^5\) McDonagh, p. xiv