

THE FACTS ABOUT COMMUNITY WATER FLUORIDATION

By Pat Abbey, DDS, MSc, DDPH; Michael Finkelstein, MD, MHSc, FRCPC; and Dick Ito, DDS, MSc, FRCD(C)



ONTARIO CENTRE
FOR ENGINEERING
AND PUBLIC POLICY

THIS ARTICLE HAS been written in response to “The role of professional engineers in maintaining the policy of municipal water fluoridation in Ontario,” published in the September/October 2013 issue of *Engineering Dimensions*. The information presented in the article by Cooper, Gagachev and Gupta may discredit community water fluoridation by putting forward only one view, and it may create a state of unease among municipal decision makers and the voting public. This article attempts to provide an alternative review of the scientific literature and, in the process, respond to the authors’ claims about community water fluoridation.

Professional engineers in water departments and public health have always worked together on issues arising from drinking water. Professional engineers have provided their technical expertise and public health, the health outcomes.

RESEARCH ON COMMUNITY WATER FLUORIDATION

The research on community water fluoridation is extensive (more than 3000 studies or research papers by one estimate) and dates back to 1908. Researchers in many different countries have since published their findings in recognized, peer-reviewed professional journals. Numerous systematic reviews and reviews by governments—national, state/provincial and local—have been published in Europe, the United Kingdom, Ireland, Australia, the United

States and Canada (Orillia Public Works). The overall conclusions from these reviews indicate:

- water fluoridation is still effective in reducing dental decay (McDonagh et al.);
- fluoridation benefits all residents, regardless of their age, education or social or economic status (Truman et al.);
- fluoridation is the most efficient method, in terms of overall cost and population coverage, for the prevention of dental decay (Levy et al.);
- the weight of evidence from all currently available studies does not support a link between exposure to fluoride in drinking water at the maximum allowable concentration (MAC) for fluoride of 1.5 mg/L and any adverse health effects, including those related to cancer, immunotoxicity, reproductive/developmental toxicity, genotoxicity and/or neurotoxicity (Health Canada—guideline); and
- the Canadian MAC of 1.5 mg/L for fluoride in drinking water has also been established by the World Health Organization (WHO), Australia and the European Union (naturally fluoridated water) (Health Canada—guideline).

The weight of the scientific evidence on the benefits of community water fluoridation has led to this preventive intervention being supported by a growing list of more than 100 North American and international organizations that recognize its public health benefits for preventing dental decay (American Dental Association). As seen in the table, among these organizations is the American Water Works Association (AWWA), whose 50,000 members manage and treat drinking water. The AWWA policy, revised January 12, 2012, states: “The American Water Works Association (AWWA) supports the recommendations of the World Health Organization (WHO), American Medical Association (AMA), Canadian Medical Association (CMA), Centers for Disease Control (CDC), American Dental Association (ADA), Canadian Dental Association (CDA), and other professional organizations in the medical community, for the fluoridation of public water supplies as a public health benefit.”

Health Canada’s Federal-Provincial-Territorial Committee on Drinking Water is responsible for the *Guidelines for Canadian Drinking Water Quality*. These health-based guidelines provide the maximum allowable levels for almost 100 physical, chemical and radiological parameters for drinking water, both fluoridated and non-fluoridated, and are available on Health Canada’s website (Health Canada—water quality). These guidelines are updated regularly and the present guidelines replace ones that were published in 1996. The guideline for each physical, chemical and radiological parameter, including fluoride, are “developed through a documented

process which includes a literature review, internal and external peer-reviews, public consultations and Federal-Provincial-Territorial approval processes” (Health Canada, guidelines–summary table). All drinking water is monitored to meet these guidelines. In 2010, Health Canada published *Canadian drinking water quality: Guideline technical document–fluoride*.

HYDROFLUOROSILICIC ACID

Hydrofluorosilicic acid (HFSA) is the chemical used by the majority of water treatment plants in North America due to its ease of use, accuracy of measurement, and the need for a minimum amount of equipment (American Dental Association). It is the most economical of the three available compounds. The quality standard for HFSA, as with all additives to drinking water, is set by the NSF (National Sanitation Foundation)/ANSI (American National Standards Institute) Standard 60, which addresses the health effects of treatment chemicals in drinking water and is used by the Ministry of the Environment. NSF/ANSI 60 was developed using United States Environmental Protection Agency and Health Canada criteria to determine that fluoridation products are safe at their maximum use level with respect to potential chemical and radioactive impurities (City of London). For additions to drinking water systems, the NSF/ANSI 60 standard is even more stringent than the United States Pharmacopeia-Sodium Fluoride Standard used to produce pharmaceuticals (Centers for Disease Control and Prevention–fact sheet).

With regard to the levels of HFSA and arsenic, in February 2013, the NSF published data indicating that the levels of arsenic in 50 per cent of fluoridation products were non-detectable and if the product is added to drinking water at (or below) its maximum use level, all detections were at levels below the allowable concentration (National Sanitation Foundation). For lead, a number of reviews on community water fluoridation have studied the scientific literature and have concluded that water fluoridation has no effect on the solubility, bioavailability or bioaccumulation of any form of lead (Jackson, Harvey, and Young; Macek et al.; Urbansky and Shock). Health Canada’s website lists guidance for both arsenic and lead in drinking water (Health Canada–water quality).

HEALTH AND SAFETY

Water plant operators and engineers with proper education, training and maintenance of equipment can safely use fluoride additives, such as HFSA, to fluoridate drinking water. Careful handling of HFSA

is required as with a number of other chemicals/additives used in water treatment, such as hypochlorite, quicklime, aluminum sulfate, sodium hydroxide and ferrous sulfate. Guidelines on the safe use of additives to drinking water have been published by the AWWA and for fluoride additives, in particular, by the CDC (Centers for Disease Control and Prevention–training). With the many water treatment systems in Ontario that use HFSA, it is interesting to note that the Workplace Safety and Insurance Board (WSIB) reports that there have been zero lost-time injuries of municipal water systems workers related to fluoridation chemicals in the last five years.

LEGAL

Section 19 of the *Safe Drinking Water Act*, 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” (Government of Ontario). With respect to drinking water fluoridation, a professional engineer can recommend that a municipal council support fluoridation of its drinking water. This advice would be based upon recommendations by the medical officer of the health unit, Ontario’s chief medical officer of health, Health Canada, the WHO, the CDC and numerous other organizations. These individuals and organizations have indicated that drinking water fluoridation causes no harm and provides significant oral health benefits (City of London).

On informed consent, the City of London Solicitors Office has stated: “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. In the 2003 BC case of *Millership v. British Columbia*, 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 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” (City of London).

“The court also referred to the case of *Locke v. Calgary*, where the court found that the bylaw did not violate the plaintiff’s rights to security of the person and that, in any event, such a bylaw 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” (City of London).

ENVIRONMENT

A 2004 article in *The International Journal of Occupational and Environmental Health* (Pollick) looked at the evidence of water fluoridation’s effects on plants, animals and humans, based on reviews by scientific groups and individual communities and concluded: “There appears to be no concern about the environmental aspects of water fluoridation among those experts who have investigated the matter.”

POLICY ENGAGEMENT

In 2011, the European Commission's Scientific Committee on Health and Environmental Risks (SCHER) published a report on fluoride and fluoridating agents. Among the conclusions of the SCHER report is the following: "Based on three lines of evidence, a simplistic risk assessment, mass balance modeling and a modified EUSES (European Union System for Evaluation of Substances) analysis, SCHER is of the opinion that adding fluoride to drinking water at concentrations between 0.8 mg/L and the reference dose level of the WHO (1.5 mg/L) does not result in unacceptable risk to water organisms."

DENTAL FLUOROSIS

A review of the data from literature reviews does not find an elevation of dental fluorosis of aesthetic concern at the concentrations for community water fluoridation of 0.7 mg/L recommended by Health Canada (Health Canada—guidelines). The Canadian Health Measures Survey, which surveyed 1070 Canadian children ages 6 to 11 years between 2007 and 2009, found no severe fluorosis, almost no moderate fluorosis, and very little mild (4 per cent) or very mild fluorosis (12 per cent) (Health Canada—summary report).

Concern has been expressed about the perceived possibility of dental fluorosis in giving baby formula made with fluoridated water to infants. 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: "Current scientific literature does not support a link between consumption of infant formula reconstituted with drinking water containing fluoride and the risk of moderate/severe dental fluorosis" (Health Canada—guidelines).

ETHICS

The ethical aspects of drinking water fluoridation were very recently

addressed in a Province of Quebec report, which states: "In conclusion, the CESP (Comité d'éthique de santé publique) 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" (Institut national de santé publique du Québec).

"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" (City of London).

CONCLUSION

Credible scientific evidence supports the safety, effectiveness and cost efficiency of community water fluoridation. Community water fluoridation reduces health inequities and disparities for everyone in the population.

NATIONAL AND INTERNATIONAL ORGANIZATIONS THAT SUPPORT FLUORIDATION	PROVINCIAL HEALTH ORGANIZATIONS THAT SUPPORT FLUORIDATION
<ul style="list-style-type: none"> • American Cancer Society • American Water Works Association • Canadian Association of Public Health Dentistry • Canadian Cancer Society • Canadian Dental Association • Canadian Paediatric Society • Canadian Public Health Association • FDI World Dental Federation • Health Canada • Pan American Health Organization • U.S. Public Health Service • U.S. Centers for Disease Control and Prevention • World Health Organization 	<ul style="list-style-type: none"> • Association of Local Public Health Agencies • Chief Medical Officer of Health of Ontario • Ontario Association of Public Health Dentistry • Ontario Dental Association • Ontario Dental Hygienists Association • Ontario Medical Association • Ontario Public Health Association • Royal College of Dental Surgeons of Ontario

Modified from the American Dental Association's *Fluoridation Facts*, 2005, page 69.

Pat Abbey, DDS, MSc, DDPH, is president of the Ontario Association of Public Health Dentistry, and has worked in private practice, dental regulation and education. He is director, oral health division, Durham Region Health Department.

Michael Finkelstein, MD, MHSc, FRCPC, is an associate medical officer of health at Toronto Public Health, a member of the Royal College of Physicians of Canada and vice chair of the Council of Ontario Medical Officers of Health.

Dick Ito, DDS, MSc, FRCD(C), is a public health dental specialist, a member of the Royal College of Dentists of Canada, a dental consultant for two health units in Ontario and a past president of the Ontario Association of Public Health Dentistry.

REFERENCES

American Dental Association. *Fluoridation facts*, 2005, 69. Available at www.ada.org/sections/newsAndEvents/pdfs/fluoridation_facts.pdf.

American Water Works Association (AWWA). *Policy statement: Fluoridation of public water supplies*, October 25, 2013. Available at www.awwa.org/about-us/policy-statements/policy-statement/articleid/202/fluoridation-of-public-water-supplies.aspx.

Centers for Disease Control and Prevention. CDC-sponsored water fluoridation training. Available at www.cdc.gov/fluoridation/engineering/training.htm.

Centers for Disease Control and Prevention. *Water fluoridation additives fact sheet* (United States Pharmacopeia (USP) Grade Fluoride Products). Available at www.cdc.gov/fluoridation/factsheets/engineering/wfadditives.htm.

City of London. *Drinking water fluoridation in London*, Report to chair and members of the Civic Works Committee Meeting, April 23, 2012, 4, 17-20, 25. Available at <https://www.healthunit.com/uploads/075-12-appendix-a.pdf>.

Government of Ontario. *Safe Drinking Water Act, 2002*, S.O. 2002, Chapter 32, Available at www.e-laws.gov.on.ca/html/statutes/english/elaws_statutes_02s32_e.htm.

Health Canada. *Guidelines for Canadian drinking water quality: Guideline technical document—fluoride*, 2010, 24-57, 63-64. Available at www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/2011-fluoride-fluoreure/index-eng.php.

Health Canada. *Summary report on the findings of the oral health component of the Canada health measures survey 2007-2009*, 41. Available at www.fptdvwg.ca/assets/PDF/CHMS/CHMS-E-summ.pdf.

Health Canada. *Guidelines for Canadian drinking water quality—summary table*. Available at www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/2012-sum_guide-res_recom/index-eng.php.

Health Canada. *Water quality—reports and publications*. Available at www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php.

Institut national de santé publique du Québec, Comité d'éthique de santé publique. *Opinion on a project to fluoridate drinking water*, March 2012. Available at www.inspq.qc.ca/pdf/publications/1422_AvisProjetFluorurationEauPotable_VA.pdf.

Jackson P.J., P.W. Harvey, and W.F. Young. *Chemistry and bioavailability aspects of fluoride in drinking water*. Report No.: CO 5037, July 2002, 1-2. Available at www.bfsweb.org/documents/wrcreport.pdf.

Levy, M., et al. *Water fluoridation: An analysis of the health benefits and risks*. Institut national de santé publique du Québec. 2007. Available at www.inspq.qc.ca/pdf/publications/705-waterfluoruration.pdf.

Macek, M.D., et al. "Blood lead concentrations in children and method of water fluoridation in the United States," 1988–1994. *Environmental Health Perspect* 114:130–134 (2006). October 12, 2012. Available at www.ncbi.nlm.nih.gov/pubmed/16393670.

McDonagh, M., et al. *A Systematic review of public water fluoridation*. NHS Centre for Reviews and Dissemination, University of York, 2000. Available at www.ncbi.nlm.nih.gov/pmc/articles/PMC27492/.

National Sanitation Foundation. *NSF fact sheet on fluoridation chemicals*, 4-6. Available at www.fluoridealert.org/wp-content/uploads/nsf-2012.pdf.

Orillia Public Works Department. Report No. PW-12-043 to the Council Committee—Public consultation on fluoridation report, July 06, 2012, 18. Available at www.simcoemuskokahealth.org/Libraries/TOPICTOPIC/OralHealth/20120706_CityReport_CWF.sflb.ashx.

Pollick, H. "Water fluoridation and the environment: Current perspective in the United States." *International Journal of Occupational and Environmental Health* 2004, 10:343–350. Available at www.ncbi.nlm.nih.gov/pubmed/15473093.

Scientific Committee on Health and Environmental Risks. *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, p. 35. Available at http://ec.europa.eu/health/scientific_committees/environmental_risks/docs/scher_o_139.pdf.

Truman, B., et al. "Reviews of evidence on interventions to prevent dental caries, oral and pharyngeal cancers and sports-related craniofacial injuries." *American Journal of Preventive Medicine* 2002; 23(1S): 21-54. Available at www.thecommunityguide.org/oral/oral-ajpm-ev-rev.pdf.

Urbansky E.T. and M.R. Schock. "Can fluoridation affect lead(II) in potable water? Hexafluorosilicate and fluoride equilibria in aqueous solution." *International Journal of Environmental Studies* 2000; 57: 597-637. Available at www.cdc.gov/fluoridation/pdf/urbansky_schock.pdf.

Workplace Safety Insurance Board. Ontario: Lost time injuries for water systems. Request ID: 634E, February 02, 2012. Appendix J, Orillia Public Works Department Report No. PW-12-043 to the Council Committee—Public consultation on fluoridation report, July 06, 2012.

POISONED POLITICS OF POWER PLANTS

By Jatin Nathwani, PhD

WITH ONE UGLY phase of Ontario politics about to recede into the fog of memory—prorogation of the legislature and the resignation of a premier—it would be false hope to assume the cost burdens of the cancelled gas power plants in Mississauga and Oakville would also fade.

Within hours of congratulatory messages upon Kathleen Wynne's selection as leader and premier, the opposition parties were calling for an inquiry into the cancellation of the gas plants. Such swift demands remind one of Banquo's presence at Macbeth's feast—unwelcome and unsightly—with no respite for Premier Wynne to begin the difficult task of addressing Ontario's broader fiscal challenges.

The energy file may well have turned into a ball and chain for the premier as shown by the loss of seats in the recent provincial byelections. Although this was a problem not of her making, the persistence of the controversy surrounding the cancellation of the gas plants has wider ramifications beyond Ontario and beyond concerns over the specific costs, high as they are, of cancelled contracts.

A different lesson also emerges from the fiasco of the cancelled power plants. It is the role of citizen outrage and its unintended consequences on the public interest. When Dalton McGuinty resigned and the legislature was prorogued, self-righteous indignation against the way politics is practised had taken full-throated fulminations to new heights. I challenge this glum self-satisfaction we collectively indulge in by pointing fingers at our politicians. Do remember, when you point a finger there is also the thumb and three others pointing at you.

Yes, active citizen participation in shaping public policy is critical to the democratic process, but acceding to the demands of unbridled citizen outrage is a recipe for trouble unless circumscribed by responsible obligations. Good citizens of Oakville and Mississauga were particularly effective in organizing their protest against two natural gas power plants in their neighborhoods. Going into the 2012 general election, two of the three major political parties were singing from the same song sheet: promises to cancel the plants. A principled stand by the government would most likely have alienated the voters. The politics of electoral calculus prevailed. Premier McGuinty ordered the plants to be cancelled and the immediate outcome was positive for the Liberals who won the seats that were at stake.

Has this served Ontario well? And, if public outrage becomes the determinant of siting decisions for energy facilities, what lessons can be learned? Decisions made in haste invariably lead to waste and, in this case, the painfully high costs are becoming evident.

As citizens, we insist politicians should respond to our demands and, when they do, criticize them for doing so. Even the most hardened cynic would have to concede that such a dysfunctional view is neither fair to politicians nor conducive to good governance. There is little comfort in stating that during the election campaign all the Ontario political parties sought to curry the voters' favour and chose the path of least resistance with nary an explanation that there would be financial burdens that would have to be imposed on all the ratepayers. The idea that we all might have to share the pain was absent from the conversation.

The downstream consequences of demands—whether cost, reliability or the risk of blackouts—are never a core consideration for any protest movement. If protest equals turning my problem into someone else's problem, it is not responsible citizenship. The cost of cancellations is large and the pain will have to be distributed across the province upon all citizens and not just the somnambulant citizens of Oakville. Salutary would be the day when citizen groups that coalesce around opposition to pipelines, power plants or power lines are willing to engage in a meaningful conversation about costs and the unintended impacts that might arise from their specific demands.

The implications for governance are even more disturbing. One community's outrage translated into no room for any of the political parties. The necessary "neutral white space" for a meaningful dialogue on how we plan for, build and pay for society's critical energy infrastructure disappeared. All that remained was the fixing of blame and acrimony that led to a paralysis of the legislature and prorogation. If such measures become the only effective way for a government to respond to intense pressures, the diminution of the democratic process is a far more serious threat than the cost of the cancelled power plants. We need to be wary of citizen outrage if it is a one-way path into a mud pit out of which there is no clean outcome for anyone.

A WAY FORWARD TO ADDRESS THE GOVERNANCE CHALLENGE

To contain and channel citizen discontent toward positive outcomes for the broader public good is a difficult task under the best of circumstances. As protests mount over the environmental footprint of pipelines or power lines, specific projects become prized targets for marshaling dissent around concerns for the environment and social acceptability. What options do we have to provide a quality space for debate but not allow the decision process to be hijacked by special interest constituencies?

The balancing task of competing interests is best performed by our elected representatives in the legislatures and parliament. A further strengthening of the role of existing "arm's-length" expert agencies and a commitment not to undermine their legitimacy is one important consideration, whether it is the Ontario Power Authority, the National Energy Board or Environment Canada. Such academic institutions and august

bodies as the Council of Canadian Academies also have the capacity to provide and augment evidence-based independent advice to help governments wade through controversial issues.

For "real-time" input into decision making, increasing the scope and extent of subject matter expertise and availability of expert resources to MPPs, MPs and parliamentary committees is a step in the right direction. Another fundamental change would be to create a path for the government's expert agencies to involve the legislative committees at an early stage in the development of recommendations.

The need is to de-fang controversy early. Parliamentary committees ought to play a more effective role in owning decisions, thereby reducing partisan acrimony. If advice, as final recommendations, flows only one way from the expert agencies to the government through the minister, the tendency for opposition parties is to oppose, rather than devote efforts to building a consensus. However, with a change in the strategy for governance, if the recommendations and advice flowed through an "all-party committee" of the legislature or parliament, there would be a better chance of early buy-in and acceptance of choices that may appear unpalatable at first.

Significant additional expert resources devoted to the legislative and parliamentary committees to help vet and evaluate recommendations from expert agencies at an early stage in the planning and development of options can help deepen the civic dialogue, lower the decibel levels, and provide broader legitimacy to controversial decisions. Subsequent approval by parliament would then help remove the sting of partisanship associated with such decisions because parliament is the ultimate arbiter of public interest.

The key lesson from the Ontario experience—just as relevant for Canada and other provinces—is that rage and protest can seriously undermine our ability to develop a modern energy infrastructure. The ramifications of extreme protest go beyond Ontario and this will be true for the development of public infrastructure projects writ large—whether they are power plants, transmission lines, pipelines, shipping routes or transportation corridors. If citizen outrage remains decoupled from citizen responsibility, Canada's ability to foster energy trade and national economic competitiveness will remain challenged. **Σ**

Jatin Nathwani, PhD, is a professor and Ontario research chair in public policy for sustainable energy, and the executive director, Waterloo Institute for Sustainable Energy, University of Waterloo.