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A PROPOSAL TO ELIMINATE FLUORIDATION ACROSS ALL DND/CAF WATER TREATMENT PLANTS: COSTS/RISKS VS. BENEFITS ANALYSIS

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AIM

1. The aim of this service paper is to provide the Chief-of-Staff (Infrastructure and Environment) (COS(IE)) with information supporting the initiation of a Department of National Defence/Canadian Armed Forces (DND/CAF)-wide policy to eliminate water fluoridation at all institutional water treatment plant (WTP) facilities. This topic is of relevance to Assistant Deputy Minister (IE) (ADM(IE)), who is responsible for fluoridation policy implantation at WTPs. The proposed policy change would require dialogue with the CAF Surgeon General, who, perhaps on the advice of the CAF Director of Dental Services, may resist deviation from the current policy.

INTRODUCTION

2. Fluoridation is the process of intentionally adjusting the fluoride level in drinking water to a concentration that attempts to optimize benefits to dental health.¹ This process is accomplished through the addition of the correct concentration of a fluoride chemical to the water supply, usually at a water treatment plant, at a constant rate.² Past research has purported to show that fluoridation can prevent or halt tooth decay by inhibiting bacterial growth and tooth demineralization, and promoting re-mineralization.³ Fluoridation, however, is an extremely contentious issue and decreasing numbers of Canadian communities have been providing fluoridated water over the last few decades over health and ethical reasons. Since 2000, for example, several large cities (*e.g.*, Quebec City,

¹Health Canada, "Fluoride and Human Health," accessed 27 January 2016, <http://www.hc-sc.gc.ca/hl-vs/iyh-vsv/environ/fluor-eng.php>.

²Frank R. Spellman, *Handbook of Water and Wastewater Treatment Plant Operations*, 3rd ed. (Boca Raton, Florida: Taylor & Francis, 2014), 169.

³Centers for Disease Control and Prevention, "Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States," *Morbidity and Mortality Weekly Report* 50, no. RR-14 (17 August 2001): 3.

Moncton, Gatineau, and Calgary) and numerous smaller cities have discontinued fluoridation.⁴

3. This service paper will proceed by explaining the current support for community water fluoridation, followed by arguments against the process. Subsequently, the current DND/CAF fluoridation policy will be stated, and the requirement from initiatives such as Defence Renewal and Real Property Management Renewal to undertake all possible efforts to improve business practices will be discussed. An explanation of the tenuous link between fluoridation and operational readiness will be provided, in addition to explanations of the hazards of fluoridation to health, safety, and the environment. Following a case study of fluoridation operations at 5th Canadian Division Support Base (5 CDSB) Gagetown, courses of action (COAs) will be presented for amending the DND/CAF fluoridation policy. The recommendation will be made that the COS(IE) initiate dialogue with the CAF Surgeon General with a view to changing the current DND/CAF policy to one of institution-wide non-fluoridation.

DISCUSSION

4. The first community in the world to fluoridate water was located in the United States in 1945; the first Canadian city commenced later the same year.⁵ Fluoridation to prevent tooth decay is supported by over 85 professional health organizations across the globe, including Health Canada, the Canadian Dental Association, the American Centers for Disease Control and Prevention, the Australian National Health and Medical Research

⁴Stoneman, Wallar, and Papadopoulos, *Community Water Fluoridation...*, 4.

⁵N. Young *et al*, "Community Water Fluoridation and Health Outcomes in England: A Cross-Sectional Study," *Community Dentistry and Oral Epidemiology* 43, no. 6 (December 2015): 550; Danielle Rabb-Waytowich, "Water Fluoridation in Canada: Past and Present," *Journal of the Canadian Dental Association* 75, no. 6 (July/August 2009): 451.

Council, and the World Health Organization.⁶ Today, approximately thirty countries employ fluoridation, with great variation in the percentage of their populations receiving fluoridated water.⁷ The most recent published data by Health Canada, from 2007, showed that approximately 45% of Canadians live in areas receiving fluoridated water, with great variation across the provinces and territories, ranging from zero percent in Nunavut and Yukon Territories to 76% in Ontario.⁸ The decision whether to fluoridate is made by individual municipalities (sometimes following a plebiscite), with the federal, provincial, and territorial governments collaborating to establish guidelines and regulations.⁹ Health Canada's most recent fluoridation guideline, published in 2010, is 0.7 milligrams per litre (mg/L).¹⁰

5. One health impact that is clearly supported by scientific research is fluorosis, caused by excessive ingestion of fluoride during tooth development (usually age 0-8), the period when dental tissues are most sensitive.¹¹ Permanent impacts from fluorosis range from hardly visible white marks on tooth enamel to severe pitting of the teeth.¹²

Opponents of fluoridation point to the increasing sources of fluoride exposure from various fluoridated products, including toothpaste, mouth rinses, dietary supplements, infant formula, and commercial goods (*e.g.*, beverages, food) as exacerbating risks of

⁶Health Canada, "Fluoride and Human Health..."

⁷Mary Tiemann, *Fluoride in Drinking Water: A Review of Fluoridation and Regulation Issues* (Washington, DC: Congressional Research Service, 2013), 30-31. Examples of the variation in percentage of the population receiving fluoridated water includes Singapore (100%), Israel (75%), Australia (61%), Chile (40%), Argentina (21%), and the United Kingdom (10%).

⁸Julie Stoneman, Lauren Wallar, and Andrew Papadopoulos, *Community Water Fluoridation in Canada – Trends, Benefits, and Risks* (Vancouver: National Collaborating Centre for Environmental Health, 2014), 4, 9. Data for other provinces includes British Columbia (4%), Alberta (75%), Saskatchewan (37%), Manitoba (70%), Quebec (6%), New Brunswick (26%), Nova Scotia (57%), Newfoundland and Labrador (2%), and Northwest Territories (56%).

⁹Rabb-Waytowich, "Water Fluoridation in Canada...", 451.

¹⁰Stoneman, Wallar, and Papadopoulos, *Community Water Fluoridation...*, 4.

¹¹Tiemann, *Fluoride in Drinking Water...*, 4.

¹²B.F. Gooch *et al.*, "U.S. Public Health Service Recommendation...", 3.

unhealthy fluoride ingestion levels. Another opposition to fluoridation that receives much support is that it constitutes unethical mass-medication of the public, who then have no choice whether to consume the fluoride.¹³ Opponents to fluoridation have attempted to link fluoridation with cancer, low intelligence quotient levels, bone fractures, neurotoxicity, immune-toxicity, reproductive toxicity, and many other negative health impacts.¹⁴

6. In 1968, the DND adopted a policy of mandatory water fluoridation at all DND/CAF WTPs.¹⁵ By 2007 (the exact date was unable to be confirmed) this policy had changed to now being left at the “discretion of the base/wing/municipalities to decide whether or not to fluoridate DND/CAF water supplies.”¹⁶ Therefore, for bases or wings having a WTP, the Base or Wing Commander made the final decision. In January 2013, presumably to bring the Canadian Forces in step with the Health Canada guideline published in 2010, the CAF Director of Dental Services, Colonel James C. Taylor, issued a position statement recommending all CAF bases having a WTP to adjust fluoridation to 0.7 mg/L.¹⁷

7. Leaving the decision whether to fluoridate at the base level has led the DND/CAF to inconsistent fluoridation practices across its various bases. While some bases still

¹³Z. Iheozor-Ejiofor *et al*, “Water Fluoridation to Prevent Tooth Decay,” *Cochrane Database of Systematic Reviews 2015*, no. 6 (June 2015): 9-10; Paul Connett, James Beck, and H.S. Micklem, *The Case Against Fluoride: How Hazardous Waste Ended Up in Our Drinking Water and the Bad Science and Powerful Politics that Keep it There* (White River Junction, Vermont: Chelsea Green Publishing Company, 2010), 31.

¹⁴Rabb-Waytowich, “Water Fluoridation in Canada...,” 453; B.F. Gooch *et al*, “U.S. Public Health Service Recommendation for Fluoride Concentration in Drinking Water for the Prevention of Dental Caries,” *Public Health Reports* 130, no. 4 (July/August 2015): 7-9.

¹⁵Lindsay McLaren and J.C. Herbert Emery, “Drinking Water Fluoridation and Oral Health Inequities in Canadian Children,” *Canadian Journal of Public Health* 103, no. 7 (September/October 2012): S51.

¹⁶Department of National Defence, C-98-15W-002/MG-010, *Water Supply and Distribution Systems* (Ottawa: DND Canada, 2007), 3-73.

¹⁷Colonel James C. Taylor, *Position Statement on 21 January 2013 from the Canadian Forces Director of Dental Services on Community Water Fluoridation on Canadian Forces Bases* (Ottawa: DND Canada, 2013).

continue to fluoridate, such as 5 CDSB Gagetown and Canadian Forces Base (CFB) Suffield, other bases have since decided to eliminate fluoridation practices in their WTP. For example, CFB Kingston, who supplies water to residents in the city's east end, ceased fluoridation in 2008.¹⁸ In addition, CFB Wainwright, who supplies water to the Town of Wainwright, eliminated fluoridation in 2012.¹⁹ Full data on which DND/CAF WTPs do and do not fluoridate was unavailable for inclusion in this service paper, but would be needed for more detailed analysis of this issue.

8. Numerous DND/CAF initiatives are actively seeking to eliminate needless costs and inconsistent local policies. Established by the Deputy Minister and Chief of Defence Staff in 2012, Defence Renewal seeks to evolve the DND/CAF into a “lean and efficient organization” that is constantly seeking improvement in business practices, with the goal of freeing resources for subsequent application in operational capabilities and providing value to Canadians.²⁰ Infrastructure is a specific area where Defence Renewal seeks to economize, citing that the “current business model for managing real property is decentralized, fragmented, and...has led to ineffective use of capital construction and maintenance and repair budgets, inconsistent delivery standards...”²¹ Furthermore, the DND/CAF's inconsistent local infrastructure policies, lack of national policies, and lack of adequate maintenance and repair budgets had been criticized in the 2012 Fall Report of the

¹⁸Jordan Press, “CFB Kingston Ending Water Fluoridation, East End to Lose its Fluoride,” *The Kingston Whig-Standard*, 28 May 2008.

¹⁹Kelly Clemmer, “Fluoride Will No Longer Be Added to Water Supply,” *Star News*, last modified 12 December 2012, http://www.starnews.ca/news/article_f5e99866-4480-11e2-bd4e-0019bb30f31a.html.

²⁰Department of National Defence, DGM-13-06-01472, *Defence Renewal Charter* (Ottawa: DND Canada, 2013), 5, 7.

²¹*Ibid.*, 15.

Auditor General of Canada.²² In an effort to better streamline and centralize the DND/CAF real property portfolio management, the Real Property Management Renewal program was initiated immediately following direction contained in the federal government's Budget 2012.²³ Initiatives such as Defence Renewal and Real Property Management Renewal challenge those in the IE domain to reassess and question practices that impact IE human and financial resources.

9. There are numerous factors leading to significant limitations regarding the effectiveness of fluoridation programs undertaken by some DND/CAF WTPs, and/or lead to a wholesale reassessment of whether fluoridation should even be permitted to occur in these facilities. Such factors include (i) the tenuous relationship of fluoridation and CAF operational readiness, (ii) military posting cycles, (iii) whether military members are receiving fluoridated water at their place of residence, and (iv) various safety and environmental considerations.

10. In 2013, the CAF Director of Dental Services stated that fluoridation contributes to oral health and operational readiness.²⁴ However, the Cochrane Collaboration (Cochrane), an international, non-profit organization producing highly authoritative systematic reviews of impacts from health-care interventions,²⁵ produced a review of fluoridation research in June 2015 yielding the important conclusion that there was no evidence of fluoridation benefits for adults. In addition, while they assessed that fluoridation is effective at

²²Auditor General of Canada. *Fall 2012 Report of the Auditor General of Canada* (Ottawa: Office of the Auditor General of Canada, 2012), 2.

²³Department of National Defence, *IE Focus Internal Newsletter*, April 2014, accessed 28 January 2016, <http://www.multibriefs.com/briefs/cmea/focusenglish.pdf>.

²⁴Taylor, *Position Statement...*

²⁵R.J.P.M. Scholten, M. Clarke, and J. Hetherington, "The Cochrane Collaboration," *European Journal of Clinical Nutrition* 59, suppl. 1 (August 2005): S147.

lowering rates of child tooth decay (35% lower in baby teeth; 25% lower in permanent teeth), in locations where the fluoridation rate is approximately 0.7 mg/L, approximately 12% of people will have fluorosis that will cause esthetic concerns.²⁶ This is not the first time these general deductions have been reached.²⁷ Thus, this recent Cochrane study is the latest in a series of findings appearing to validate the argument against ongoing base fluoridation as a contributor to CAF operational readiness. Instead, DND/CAF efforts to ensure oral health through the requirement for regular force members to complete annual dental examinations, and have access to dental cleaning services, would seem to be the effective components of the CAF's current oral health strategy.

11. Even if fluoridation was conclusively found to have some measure of benefit for adults, an assertion not supported by the Cochrane study mentioned above, its efficacy would often be hindered by additional factors. The first factor is the vast distribution of member residence locations from the base. As such, most military members do not live in communities that receive drinking water from a DND/CAF WTP, or do not live within an area that does receive water from a DND/CAF WTP that has chosen to fluoridate. The second factor is the high frequency military posting cycles that often alternately take members to and from fluoridated and non-fluoridated locations. The Cochrane study highlighted that one of the key drivers of a decision to start a fluoridation program is an appreciation of the movement and migration of the target population, as well as their

²⁶Z. Iheozor-Ejiofor *et al*, "Water Fluoridation to Prevent...", 2.

²⁷N.F. Gray, *Drinking Water Quality: Problems and Solutions*, 2nd ed. (Cambridge, England: Cambridge University Press, 2008), 286-295; Donald W. Millar, "Fluoridation of Public Drinking Water is Not Beneficial and Can Be Harmful," in *Water*, ed. Jacqueline Langwith (Detroit: Greenhaven Press, 2010), 210-212.

consumption of tap water.²⁸ As such, consistent exposure to fluoridated water would be required for maximum effectiveness of any benefits. Yet, within the CAF, members are frequently posted to different geographical locations, often only spending 2-4 years in any particular location. A third factor is that water consumed by troops in training areas can originate from non-fluoridated well water. This is the case at 5 CDSB Gagetown, the Canadian Army's largest training base.²⁹ During the time that troops are on exercises in such locations, when oral hygiene is least likely to be fully practiced and teeth are therefore most vulnerable, their teeth are not being fluoridated. In sum, taking these three factors into consideration, it is therefore likely that members will inevitably consume highly inconsistent levels of fluoridated water throughout their career, greatly reducing any positive impact that fluoridation might bring.

12. Safety considerations surrounding the implementation of a fluoridation program are significant in the decision-making process. The two principal safety concerns arise from hazards to WTP personnel and risks of equipment malfunction. Additional environmental risks can arise from a spill of chemicals used for fluoridation.

13. The chemicals used for fluoridation programs are a severe safety hazard to WTP personnel unless proper handling procedures and personal protective equipment is used. For example, the fluorosilicic acid used in many WTPs can cause delayed burns on skin tissue, and the hydrofluoric acid associated with the use of fluorosilicic acid is extremely corrosive and demands careful handling.³⁰ The fumes from fluorosilicic acid are extremely

²⁸Ibid., 3.

²⁹Kevin Smith, Supervisor of 5 CDSB Gagetown Water Treatment Plant, telephone conversation with author, 29 January 2016.

³⁰Ibid., 167.

toxic, and during filling operations, certified personal protective equipment such as respirators, splash-proof goggles, an apron, and rubber gloves must be used. As well, eye wash stations, deluge showers, and room ventilation systems are necessary safety equipment for the protection of plant personnel.³¹ When CFB Wainwright decided to halt fluoridation of WTP water in 2012, the Base Commander publically stated that the benefits of fluoridation were small in comparison with the significant health and environmental risks: The “health benefits are not that much,” but that “fluorosilicic acid is a hazardous material which creates concerns, not only for the health and safety of the staff dealing with it on a regular basis, but also for the environment should a spill ever occur.”³²

14. Fluoridation injection equipment is often assessed to be marginally non-compliant with required regulatory standards.³³ More dangerously, several water treatment plants over the years have reported fluoride releases due to malfunctioning fluoridation systems. While such instances are rare, the small probability of their occurrence results in an ongoing additional public health risk in fluoridated communities.³⁴ For water originating from a DND/CAF WTP, this risk is borne by DND/CAF. Associated operation and maintenance costs for injection systems include routine measurement of fluoride concentrations in water to ensure compliance with regulations, preventative maintenance to fluoridation systems, maintenance of drills and equipment related to leakage response, and periodic safety training.³⁵

³¹Mackenzie Davis, *Water and Wastewater Engineering: Design Principles and Practice* (Boston: McGraw-Hill Education, 2010), 13-45.

³²Clemmer, “Fluoride Will No Longer Be Added...”

³³R. Allan Freeze and Jay H. Lehr, *The Fluoride Wars: How a Modest Public Health Measure Became America’s Longest-Running Melodrama* (Hoboken, New Jersey: John Wiley & Sons, 2009), 359.

³⁴*Ibid.*, 359.

³⁵Davis, *Water and Wastewater Engineering...*, 13-46.

15. Although the various health, safety, environmental, and ethical reasons for halting DND/CAF fluoridation supersede those related to costs, the latter is not negligible. The Faculty of Dentistry at the University of Toronto recently published data stating that a small community fluoridation program costs approximately \$4.00 per person.³⁶ For example, producing fluoridated water for the Town of Oromocto, whose 2011 census population was 8,932,³⁷ would result in an annual cost to the 5 CDSB Gagetown WTP alone of \$35,728 per year. This cost is made more unnecessary by the fact that high numbers of personnel do not drink water on the base due to discolouration issues and/or reside outside of Oromocto and therefore do not receive fluoridated water at their place of residence.³⁸ As of March 2014, the 5 CDSB Gagetown WTP is the only community water facility in New Brunswick that is fluoridating water.³⁹ A request to halt fluoridation for reasons of cost, safety, and inefficiency was forwarded to the Commander of 5 CDSB Gagetown from the Base Construction Engineering Officer (BCEO) in approximately 2008. Based on the advice of the Base Dental Officer, this request was denied.⁴⁰

Calculating the total cost of fluoridating across all DND/CAF WTPs would require a study of which facilities have implemented a fluoridation program.

³⁶University of Toronto, Faculty of Dentistry, *Water Fluoridation: Questions and Answers* (Toronto: University of Toronto, 2012), 74.

³⁷Statistics Canada, "Focus on Geography Series, 2011 Census, Census Subdivision of Oromocto, T-New Brunswick," accessed 6 February 2016, <https://www12.statcan.gc.ca/census-recensement/2011/as-sa/fogs-spg/Facts-csd-eng.cfm?LANG=Eng&GK=CSD&GC=1303012>.

³⁸Kevin Smith, Supervisor of 5 CDSB Gagetown Water Treatment Plant, telephone conversation with author, 29 January 2016. Mr. Smith estimates that approximately 50% of base personnel do not drink the water on the base due to discolouration issues, which is a result of oxidation of base water distribution lines. This problem is not present in Oromocto's water distribution lines.

³⁹Canadian Broadcasting Corporation, "Saint John Council Votes to Stop Putting Fluoride in Water," last modified 11 March 2014, <http://www.cbc.ca/news/canada/new-brunswick/saint-john-council-votes-to-stop-putting-fluoride-in-water-1.2567770>.

⁴⁰Kevin Smith, Supervisor of 5 CDSB Gagetown Water Treatment Plant, telephone conversation with author, 29 January 2016.

16. In light of the questionable benefits of fluoridation, and the numerous confirmed or possible hazards, the following COAs are offered for consideration:

- (a) COA 1. Maintain the current policy, leaving the decision of whether to fluoride with Base/Wing Commanders, until further scientific and cost data is available that would provide greater clarity on whether to seek the elimination of fluoridation at DND/CAF WTPs.
- (b) COA 2. Maintain the current policy, but direct BCEOs in locations where fluoridation is occurring to collaborate with Base/Wing Dental Officers to provide Base/Wing Commanders with advice, based on local conditions, regarding the possible benefits and numerous health, safety, environmental, and ethical concerns with the practice.
- (c) COA 3. The COS(IE) initiates a dialogue with the CAF Surgeon General to discuss a CAF-wide policy for the elimination of any fluoridation at DND/CAF WTPs.

CONCLUSION

17. There is increasing scientific agreement that fluoridation only benefits children by lowering the incidence of dental decay during the development of their teeth, with adults receiving little to no benefit. As such, the claim that fluoridation of DND/CAF water brings operational readiness benefits is not founded. Furthermore, fluoridation carries many hazards including (i) risk of fluorosis, (ii) controversially links to more serious health effects (*e.g.*, cancer), (iii) safety hazards to WTP personnel, and (iv) safety hazards

to consumers of water resulting from risk of overfeed due to equipment malfunction. Even if fluoridation was conclusively found to have some benefit to adult oral health, these benefits would be minimized for military members due to inconsistent exposure to fluoridation from frequent posting cycles in and out of areas implementing a fluoridation program. Lastly, the ethics of mass-medication and the small but not insignificant cost of fluoridation per WTP also requires consideration.

RECOMMENDATION

18. Based on the limited benefits of fluoridation practices, and the health, safety, environmental, and ethical liabilities that the practice poses, COA 3 is recommended. COA 3 is further justified by current DND/CAF initiatives such as Defence Renewal and Real Property Management Renewal, both of which highlight the need for improved business practices, better centralization and harmonization of infrastructure policies, and reduction of unnecessary costs which can result in savings to be subsequently reinvested in operational requirements.

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