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Rethinking the risks and benefits of fluoridation

By Sheldon Thomas

Among the responses to my article '*What are the long-term effects of fluoridation?*', published in the September/October 2012 edition of Environmental Science & Engineering Magazine, it was correctly pointed out that I am neither an expert on public health or a medical doctor. I am, instead, a student of drinking water quality and of the infrastructure systems that deliver finished water to Canadians. I can assure you, however, that I have been a very good student for 38 years.

For 36 of those 38 years I accepted fluoridation as just another step in drinking water production. Then I viewed a tape of Dr. William Hirzy, senior scientist at the USEPA's Risk Assessment Division Office of Pollution Prevention and Toxics, addressing a US Senate Committee on Environment and Public Works. Dr. Hirzy was representing the USEPA Union of Scientists, and their collective plea was for Congress to impose an immediate moratorium on water fluoridation.

Let me highlight something that is a matter of record. The USEPA administration does not condemn fluoridation, but the scientists and health professionals in its employ *do* - all 1,500 of them. Isn't that extraordinarily odd? The USEPA scientists who so strongly object to fluoridation include seasoned biochemists, pharmacologists, teratologists and toxicologists.

Dr. Hirzy pressed for a fluoridation moratorium because his research, and the studies of many others, strongly indicated that ingested fluoride ion, once entered into the bloodstream, does harm to both soft and hard tissue. I recommend that every open-minded drinking water professional watch Dr. Hirzy's video. (<http://www.youtube.com/watch?v=hRLz4a7IDVM>)

There seems to be a default assumption that health professionals and medical doctors offer the only trustworthy opinion on the health effects of fluoridation. I suggest that the most trustworthy opinion would be one offered by a competent researcher who has made it his/her mission to understand how chronic exposure to low concentrations of fluoride ion can affect humans and animals. As a water professional, I want to hear from *that* person.

There is a list of well-known health organizations, the List of 90₁, which has been cited for years by those who promote fluoridation. The List, however, is losing membership as organizations rethink their support of fluoridation. The National Kidney Foundation₂ and the National Research Council₃ are two organizations that have recently struck their names from the List. In 2011, The International Academy of Oral Medicine and Toxicology, in a letter to the CDC, stated that it would never go on the List₄. Even the Oral Health Division of the Centers for Disease Control and Prevention (CDC), although remaining on the List, has significantly adjusted its assessment of fluoridation. The CDC has twice conceded (in 1999 and 2001) that the best use of fluoride in preventing dental caries is to apply it directly to the teeth via toothpastes or fluoride gels.

The CDC is yielding to common sense. National Academy of Science researcher and Canadian expert in fluoride toxicity Dr. Hardy Limeback states, "Toothpaste has 25,000 times more fluoride than saliva fortified by ingested fluoridated water."⁵ It is pointless to expose the rest of the body to the long term risks of fluoride ingestion when fluoride can be applied directly to teeth by simply opening wide.

Since the List has been so instrumental in directing opinion on fluoridation, let's have a look at some of its signatories.

The World Health Organization (WHO) does favour fluoridation. But what is often ignored by proponents is the WHO's precautionary caveat that water fluoridation programs should not be entered into unless the municipality/water authority has conducted prior tests on residents to establish their total daily fluoride intake from all sources of food and beverage and environmental exposures. If fluoride intake is already at, or beyond, a level deemed protective of teeth, adding it to drinking water would be an excessive measure. How many fluoridating municipalities test their citizens in this manner before agreeing to start or to continue fluoridation?

I am sure that the WHO would prefer that its full statement be known.⁶

Health Canada is prominent on the List. Health Canada literature suggests that fluoridation is just a topping up of the natural fluoride that is already present in source water. That would be true if we were topping up natural calcium fluoride concentrations with additional calcium fluoride. The chemicals commonly used to deliver those additional fluoride ions are actually synthetic silicofluorides, the most favoured for use being hydrofluorosilicic acid. These chemicals are normally classified as regulated category 1 toxic wastes,⁷ but they become environmentally acceptable, and fit to ingest, the moment that they are re-labeled as water treatment 'products'. Health Canada states that these, and other silicofluorides, are safe and effective for use as fluoridating agents. But upon what does Health Canada base those assurances?

In response to an information petition submitted to the Office of the Auditor General in 2008, Health Canada had to reveal that it "does no research on silicofluoride chemicals"⁸. So, Health Canada cannot speak to the safety of silicofluorides from any results of in-house testing. Health Canada relies, instead, on NSF International (NSF), a private industry consortium, to test, certify and assure that silicofluoride chemicals are safe for use in drinking water. Unfortunately, if you read its literature closely enough, you'll note that NSF does not offer that assurance at all.⁹

NSF examines water treatment chemicals and additives to attest that they meet already-established government health guidelines, and then certifies them 'appropriate for use' if they do.¹⁰ An important distinction here is that NSF does not certify any chemical to be 'safe for use'. In its own carefully worded disclaimer in the foreword of 'NSF/ANSI Standard 60', NSF does not presume to tell anyone what to do with the chemicals that it certifies. Nor does it hold itself responsible for the *performance* of any of the chemicals that it certifies.¹¹ Chemical 'safety' is a measurement of performance.

Normally, NSF requires manufacturer-supplied toxicological testing of all drinking water treatment chemicals and additives before granting Standard 60 certification¹⁰. One is left to wonder why NSF, still missing the good-to-go paperwork on silicofluorides, has not pressed harder for the mandatory toxicology tests. Without proof of toxicological suitability, how is it that tankers are still making deliveries?

While awaiting those tests, NSF has adopted a different approach to its certification of silicofluoride chemicals. Using hydrofluorosilicic acid (HFSA) as an example, NSF has chosen *not* to examine the chemical compound as a single product.¹⁰ Instead, NSF simply identifies all of the combined constituents of HFSA, including the co-contaminants commonly found within the acid, and examines them separately for government guideline compliance. If none exceed the MACs or MCLs established by Health Canada or the USEPA, NSF certifies HFSA as appropriate for use. That's what keeps the tankers on the road.

If NSF's approach to the examination of fluoridating chemicals is insufficient in any way, it is for health authorities and governments to say so, and to request something different.

There are some who maintain that HFSA toxicology studies are unnecessary. They subscribe to the belief that, as soon as HFSA is fed into drinking water, it 'dissociates' completely and reliably into its major components, silica and fluoride ions¹². That theory can best be described as hopeful. In 2001, the USEPA was called before Congress and, under oath, had to admit that it had no credible evidence that HFSA fully dissociated in municipal drinking water¹³. After five decades of fluoridation, the USEPA could find nothing to defend the use of HFSA. At the same hearing the USEPA also revealed that it had "no information on the effects of silicofluorides on health and behaviour."¹³

I'll end examination of the List by discussing the promotion of fluoridation by the Canadian Dental Association (CDA). As fluoridation is all about the teeth, you would expect dental associations to weigh in.

The CDA joins its voice to 44 other dental organizations on the List of 90 to announce that fluoridation is both safe and effective. But, unfortunately, there is nothing in dental training that positions any dentist, or dental organization, to speak authoritatively about the interaction of the fluoride ion with soft and hard tissue throughout the body. Dentists train to become experts of the oral cavity, and within that cavity they rule. But their medical expertise generally ends there.

For any dental association to claim that fluoridation is safe, it must be able to supply proof that highly-reactive ingested fluoride ions do not cause harm to any part of the complicated human organism on their way to the teeth. There are, on average, 60,000 miles of blood vessels¹⁴ and 30 trillion red blood cells that sustain every nook and cranny of the human body. The CDA is asking us to believe that the fluoride ion, a potent enzyme killer¹⁵, is going to leave untouched all of those blood cells¹⁶ along a journey the equivalent distance of 2.5 times around the planet.

It is evident that more than half of the organizations on the List have no meaningful authority by which to assure you that fluoridated water is safe. With no scholarly foundation upon which to make the safety claim, the CDA, like the others on the List, invites you to drink until you're content.

As for the 'benefits of fluoridation that so out-weigh the harms', the CDA could tell you about the study conducted by the National Dental Research Institute (NDRI) in 1986. The \$3.7 million study was designed to measure the effect of fluoridation on dental caries reduction after 40 years of drinking water fluoride 'adjustment'. Dental researchers selected 84 different school districts, spread across the United States, comparing dental caries of children in fluoridated communities with those in non-fluoridated communities. They compared the dental records of 39,207 school children of the same age group. The data revealed that fluoridation didn't work.

In what was anticipated to be a landslide victory for fluoridation, the data revealed that there was *no statistical difference* between dental caries recorded in fluoridated communities and dental caries recorded in non-fluoridated communities. When the results of the publicly-funded study were slow to emerge, biochemist Dr. John Yiamouyiannis used Freedom of Information legislation (FOI) to pull the study into the light of day. There are several other large studies that reveal very similar findings to the NDRI study.¹⁷

It is worth pointing out that there are some prestigious scientific/medical organizations that are *not* on the List. They include the Nobel Institute, the Pasteur Institute and the National Academy of Science. These celebrated scientific icons offer a markedly different assessment of the safety and benefits of fluoridation.

The National Academy of Science (NAS) conducted a landmark review of all of the available literature on fluoridation, publishing a report in 2006 titled, 'Fluoride in Drinking Water: A Review of the EPA's Standards'. It took a balanced panel of selected researchers 3.5 years to wade through and analyze the subject material. The panel concluded that there was strong evidence that linked fluoridation to a multitude of human degenerative conditions and diseases.¹⁸ The panel sent a clear and urgent message to health authorities and governments to fast-track studies to further examine water fluoridation's links to cancers, hypothyroidism, Alzheimer's-like symptoms, skeletal degeneration, and childhood IQ and behavioural deficits.

In spite of the findings of the NAS (a health advisor to governments for 150 years), Health Canada still maintains that there is no credible evidence that water fluoridation causes any harm other than mild dental fluorosis, something that it classifies as a 'cosmetic condition'.¹⁹

Let's talk a little more about the chemicals at the heart of all of this. Health Canada appears to struggle to properly classify fluoridating chemicals. It has tried to brand fluoride as an essential nutrient²⁰, when in fact the body ticks along quite nicely without it.²¹ In 1979, the US FDA found the nutrient claim so absurd that it ordered government documents to refrain from making the statement. Then Health Canada tried to convince us that fluoride was a 'dietary fortification'. That doesn't fly either, as a body with no biological need for fluoride does not need to be fortified with more. Health Canada seems to have settled on classifying silicofluoride chemicals as water *treatment* chemicals.

I have real difficulty accepting silicofluorides to be *treatment* chemicals. There is no apparent role for fluoride in the conversion of raw water into finished drinking water. We produce drinking water that meets all of the requirements of the *Safe Drinking Water Act* in Ontario without having to add a drop or a crystal of silicofluoride chemical. So, in the treatment of drinking water, how do fluoridation chemicals 'treat', exactly?

The answer (and not a very good one) is found in the AWWA 'Water Dictionary', Second Edition, page 670. Look up 'water treatment', and you will find: (1) The act of removing contaminants from source water by the addition of chemicals, filtration and other processes, thereby making the water safe for human consumption. (2) The act of adjusting water quality to satisfy the requirements of any end use.

Fluoridation chemicals do nothing to fulfill the first part of the definition, but they slip nicely into the second part. Silicofluorides are added to drinking water singularly for their alleged ability to reduce dental caries. They are used in an attempt to suppress the *disease* of dental caries. They serve as a medication. They act as a drug. That is their *end use*.

Water professionals should be asking themselves what, if anything, part (2) of the definition has to do with part (1). Part (2) appears to have been inserted into the definition to add credibility to the use of chemicals that have no role in the production of potable water. Also, “to satisfy the requirements of any end use” is language that calls for some serious explanation. How many end uses do authorities envision for the drinking water supply?

Because HFSA, and its cousins, are regarded as water treatment chemicals, its arrival at water plants is not questioned. But anyone who receives HFSA at the plant knows that it is more than just HFSA. The acid is accompanied by a variety of co-contaminants.

Water professionals should be reminded that NSF states openly that as many as 15 different contaminants could be in any shipment of HFSA. It’s noteworthy that NSF does not require the removal of any contaminant. It just requires that they not exceed anyone’s MAC, or MCL. But MAC and MCL compliance aside, there is no escaping that impurities are being added to drinking water that is ‘adjusted’ with HFSA.

Shipments of HFSA are accompanied by a manufacturer-supplied Certificate of Analysis, a slip of paper that somehow proves that the liquid in the tanker is, indeed, NSF-certified HFSA. The certificate frequently lists lead and arsenic as present in the acid, along with their concentrations. Lead is a probable carcinogen²², and arsenic is an established carcinogen.²³

Ontario Drinking Water Quality Standards require that the concentration of arsenic in finished water not exceed 1 ppb. Health Canada stated, in 2006, that every effort should be made to keep arsenic out of drinking water.²⁴ Unfortunately, adding HFSA after treatment often *introduces* arsenic, contrary to the Health Canada recommendation. But, with arsenic getting diluted in drinking water by about 240,000 to 1, is it really *that* big of a deal? Let’s look.

NSF states that arsenic is five times more common than any other contaminant of HFSA. And it’s usually there in the highest concentration of any²⁵. NSF calculates that the arsenic typically found in HFSA will dilute down to just under 0.5 ppb in drinking water²⁵. So, clearly, the use of HFSA often adds approximately .5 ppb of arsenic to drinking water.

How scary is half a part per billion of arsenic? That’s enough to cause a fatal cancer in 1 out of 10,000 who drink fluoridated water.

The cancer estimates are the work of the National Resources Defense Council (NRDC)²⁶, using data provided by the National Academy of Science, data which the NAS earlier extracted from the USEPA’s own database. I found these estimates disturbing enough to contact the NRDC directly last summer to learn more about its February 2000 Report, "Arsenic and Old Laws". The NRDC still stands firmly behind its report, and the cancer estimates are based upon a standard, scientifically-accepted modeling methodology.

How do drinking water professionals react to this kind of information? Do we dismiss it because it’s too shocking to possibly be true? Do we dismiss it because all of those on the List claim such things cannot be so?

Faced with continuing debate over the merits of water fluoridation, civic-minded councilors struggle to identify the right path. Pulling hard at them is the recommendation of public health, mimicking statements that have not changed much across 70 years. What is known about drinking water, and what affects it, has changed massively across that time.

Water treatment operators and managers are highly-skilled, licensed and dedicated to the provision of high quality drinking water. They are the true stewards of safe drinking water, working at the very start of the process. Trained as they are, they are also less likely to be influenced by the old, and dangerous, fluoridation promotions that crumble in the light of emerging evidence and modern scientific methodology.

Councillors hear regularly from the List. They need to hear more from the Water Stewards.

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References

1. <http://www.ada.org/4051.aspx>
2. *NEW YORK, June 9 /PRNewswire-US Newswire/ -- The National Kidney Foundation withdrew its support of water fluoridation citing the 2006 National Research Council (NRC) report indicating that kidney patients are more susceptible to fluoride's bone and teeth-damaging effects. The kidney-impaired retain more fluoride and risk skeletal fluorosis (anarthritic-type bone disease), fractures and severe enamel fluorosis, which may increase the risk of dental decay, reports the NRC.*
3. *2006 National Research Council 'Fluoride in Drinking Water: A Review of the EPA's Standards'.*
4. *April 6, 2011 letter from the current President of the International Academy of Oral Medicine and Toxicology to the Director of the Centers for Disease Control and Prevention : "The solid evidence of harm we now have for susceptible, sensitive populations, untainted by politics or money considerations, is why the overwhelming consensus of our membership of hundreds of dental and medical professionals is to withdraw support for fluoridation. We cannot in good conscience continue to support the idea of people ingesting uncontrolled amounts of fluorides in drinking water."*
Matt Young, DDS
President, International Academy of Oral Medicine and Toxicology
5. *Dr. Hardy Limeback BSc., PhD., DDS, Professor Emeritus and Former Head of Preventative Dentistry, Faculty of Dentistry, University of Toronto*
6. *World Health Organization Fluoride in Drinking Water, section 4.1, 'Application of the WHO guideline values to local conditions'*
7. *Canadian Environmental Protection Act: Hydrofluorosilicic Acid is "persistent", "bio-accumulative" and "toxic".*
Environment Canada classifies hydrofluorosilicic acid as a "hazardous substance".
Transport Canada classifies hydrofluorosilicic acid as a "dangerous good".
The USEPA classifies hydrofluorosilicic acid as a "class one hazardous waste"

8. *Petition: No. 221B, Office of the Auditor General of Canada, Petitioner: Carole Clinch / Health Canada response to Q7, Q8, Q9, Q10, Q13, Q19: "Health Canada does not conduct research on the chemistry of fluoride species."*
9. *NSF/ANSI Standard 60-11, Drinking Water Treatment Chemicals-Health Effects*
10. *NSF Fact Sheet on Fluoridation Chemicals, Feb 2008*
11. *NSF/ANSI Standard 60-11, Drinking Water Treatment Chemicals-Health Effects / Disclaimers, pg iii*
12. *Crosby, N.T. 1969. Equilibria of fluorosilicate solutions with special reference to the fluoridation of public water supplies. Journal of Applied Chemistry 19:100-102.*
13. (A) *"Masters and Coplan, besides showing that silicofluorides are probably increasing lead in children, have discovered a 1975 Ph.D. thesis in German showing that silicofluorides are far from completely dissociate in water, and these partially dissociated residues are potent acetyl cholinesterase inhibitors. As a result of their work, **EPA was forced to admit to Congressman Calvert that they have absolutely "no information on the effects of silicofluorides on health and behavior."** Further, **EPA officials now admit that they are not sure that hydrofluosilicic acid completely dissociates when added to water supplies** and are planning on studies to determine what does happen. Silicofluorides have been added to drinking water supplies for 50 years without any idea of the possible consequences."
Robert J. Carton, Ph.D. Chief, Environmental Protection Office of Regulatory Compliance & Quality U.S. Army Medical Research & Material Command*
- (B) *The assumption that silicofluorides completely dissociate in water (Urbansky and Schock, 2000) has been questioned (Coplan and Masters, 2001). The possibility that intermediate species (e.g. SiF5⁻) exist under acidic conditions has been indicated (Urbansky, 2002; Morris, 2004; NRC, 2006, p. 53). Also possible is that SiF residues re-associate within the stomach (intra-gastric pH levels ~2.0; Ciavatta et al., 1988) and during food preparation, producing SiF-related species such as silicon tetrafluoride, a known toxin (Coplan, 2002).*
- (C) *Chem. Rev. 2002, 102, 2837-2854 'Fate of Fluorosilicate Drinking Water Additives', Edward Todd Urbansky.
Above is the USEPA Request For Assistance (RFA) to further investigate the dissociation of silicofluorides, as earlier ordered by the US Congress.*
14. <http://www.science-facts.com/quick-facts/amazing-human-facts/>
15. *Discussing water fluoridation, Dr. James Sumner, Nobel Prize winner for his work in enzyme chemistry, stated, "We need to go slowly, here. Everybody knows that fluorine and fluorides are very poisonous substances, and we use them in enzyme chemistry to poison enzymes, those vital agents in the body."*
16. *"We now have ample scientific evidence to substantiate the fact that ingestion of fluoride prevents biosynthesis of hemoglobin leading to anemia in human beings. We have studied this problem in pregnant mothers. The danger of anemia in pregnancy is that it would lead to abnormalities in the development of the embryo/foetus," says Dr Susheela.*

Professor (Dr) A.K. Susheela of India, Professor of Anatomy (Histocytochemistry) and Chief of the Fluoride and Fluorosis Research Laboratories at the All India Institute of Medical Sciences, New Delhi, has spent more than 20 years doing scientific research in the field of Fluoride Toxicity and Fluorosis. She has more than 80 scientific publications in leading Western and Indian Journals.

17. (1) "The most recent World Health Organization data, show that the decline in dental decay in recent decades has been comparable in 16 non-fluoridated countries and 8 fluoridated countries. The WHO data do not support fluoridation as being a reason for the decline in dental decay in 12 year olds that has been occurring in recent decades." SOURCE: Neurath C. (2005). Tooth decay trends for 12 year olds in non-fluoridated and fluoridated countries. *Fluoride* 38:324-325.

(2) "During the past 40 years dental caries has been declining in the US, as well as in most other developed nations of the world... The decline in dental caries has occurred both in fluoridated and in non-fluoridated communities, lending further credence to the notion that modes other than water fluoridation, especially dentrifices, have made a major contribution."

SOURCE: Leverett DH. (1991). Appropriate uses of systemic fluoride: considerations for the '90s. *Journal of Public Health Dentistry* 51: 42-7.

(3) "The current reported decline in caries tooth decay in the US and other Western industrialized countries has been observed in both fluoridated and non-fluoridated communities, with percentage reductions in each community apparently about the same."

SOURCE: Heifetz SB, et al. (1988). Prevalence of dental caries and dental fluorosis in areas with optimal and above-optimal water-fluoride concentrations: a 5-year follow-up survey. *Journal of the American Dental Association* 116: 490-5.

(4) "During the period 1979-81, especially in western Europe where there is little fluoridation, a number of dental examinations were made and compared with surveys carried out a decade or so before. It soon became clear that large reductions in caries had been occurring in un-fluoridated areas. The magnitudes of these reductions are generally comparable with those observed in fluoridated areas over similar periods of time."

SOURCE: Diesendorf, D. (1986). *The Mystery of Declining Tooth Decay*. *Nature* 322: 125-129.

(5) "Even the most cursory review of the dental literature since 1978 reveals a wealth of data documenting a secular, or long term, generalized decline in dental caries throughout the Western, industrialized world. Reports indicate that this decline has occurred in both fluoridated and fluoride-deficient areas, and in the presence and absence of organized preventive programs."

SOURCE: Bohannon HM, et al. (1985). Effect of secular decline on the evaluation of preventive dentistry demonstrations. *Journal of Public Health Dentistry* 45: 83-89.

18. The report documents myriad potential hazards from fluoride exposure, including damage to the bones, brain, and various glands of the endocrine system. (See excerpts of NRC's findings at: <http://www.fluoridealert.org/health/epa/nrc/excerpts.html> .) According to Dr. Bob Carton, a former risk-assessment scientist at EPA, this report "should be the centerpiece of every discussion on fluoridation. It changes everything."

19. Heath Canada: Findings and Recommendations of the Fluoride Expert Panel (January 2007) Expert Panel Members:

- Steven M. Levy, Iowa College of Dentistry
- Christopher Clark, University of British Columbia
- Robert Tardif, Université de Montreal
- Michael Levy, Institut National de Santé Publique du Québec
- Jayanth Kumar, New York State Department of Health

•Albert Nantel, Institut National de Santé Publique du Québec

20. HEALTH CANADA

"Guidelines For Canadian Drinking Water Quality Fluoride Supporting Documentation" (the Canadian federal-provincial subcommittee which just recently recommended lowering water fluoride levels to 0.8 ppm from 1.0 ppm):

"Although Health Canada classified fluoride as an essential element in the past, it now recommends that fluoride requirements can 'only be based on the beneficial effect on dental caries' and notes that 'attempts to demonstrate its essentiality for growth and reproduction in experimental animals have not been successful.'"

21. "At the heart of the matter is whether fluorine, as fluoride (F^-), should be ranked with Ca, Mg, P, and vitamin D as an essential nutrient. In fact, there is no known essential biochemical role for fluoride in any animal, including humans. The formation of sound, decay-resistant and caries-free teeth as well as strong, sturdy bones, whether in animal or human populations, does not require fluoride, or at least not in more than minuscule, trace amounts." ALBERT W. BURGSTÄHLER, Ph.D. (Organic Chemistry and Environmental Fluoride), Professor of Chemistry, The University of Kansas*, Department of Chemistry, 4035 Malott Hall, Lawrence, Kansas 66045.

22. USEPA Integrated Risk Information System (IRIS), Lead and Compounds (inorganic) (CASRN 7439-92-1), 11.A.: Evidence for Human Carcinogenicity .. Classification B: 'probable human carcinogen'

23. USEPA Integrated Risk Information System (IRIS), Arsenic (inorganic)(CASRN 7440-38-2) 11.A.: Evidence of Human Carcinogenicity ..Classification A: human carcinogen

24. Health Canada 2006 report 'Arsenic in Drinking Water': "Because arsenic can cause cancer, every effort should be made to keep levels in drinking water as low as possible."

25. April 24, 2000 / letter written by NSF's Stan Hazen, General Manager Drinking Water Additives Certification Program, to Mr. Juan Menedez, the State of Florida, Department of Public Health, Tallahassee, Florida

26. National Resources Defence Council, Feb. 2000, 'Arsenic and old Laws'