TOWN OF TOPSFIELD

FLUORIDE STUDY GROUP

8 West Common Street, Topsfield, MA 01983

April 2015

Topsfield Fluoride Study Group Recommendations and Report

1. Recommendation:

The Topsfield Fluoride Study Group unanimously recommends that the Topsfield Water Department continue to fluoridate the town water supply. Further, the study group strongly recommends that the town of Topsfield consider reducing the concentration level of fluoride in the town water supply from 1.0 part per million (ppm)[1] to 0.7 ppm, a level that is currently proposed by the US Health and Human Services Department.

2. Background:

In September 2014 a special town meeting was called in response to a citizen's petition on concerns of the town water supply and potential health issues related to added fluoride. At that meeting the town moderator was authorized to establish a five-member study group[2] to make a recommendation on the following question: "Shall the water supplied by the Town of Topsfield continue to be fluoridated?"

In a letter dated February 1, 2015 from the town moderator, George Hall, a fluoride study group was appointed. Accordingly, on March 18th, the study group held the first of a series of meetings to research the issue and return to the May 2015 Town Meeting to answer the question of continuing fluoridation of town water and provide other pertinent information on the issue if found during its research and deliberations. The study group's meetings were conducted under the Commonwealth's Open Meeting law and therefore were open to the public.

3. Research methodology:

The study group agreed at its first meeting that reports, articles or other sources of information used by the group to establish a consensus position on the benefits or risks of consumption of fluoride in the town water must be based on source material using the scientific method. Studies, controlled experiments, historical analyses, etc., were considered as potentially useful, however, all sources used for decision making were required to have the source study or data cited and available for review by study group members. Many such sources were found, and used, from Centers for Disease Control (CDC), Environmental Protection Agency (EPA), Food and Drug Administration (FDA), National Research Council (NRC), various universities and health agencies from the European Union (EU). The study group also made use of metadata reports. Metadata reports are compilations of dozens, hundreds or thousands of earlier reports, evaluated by researchers to draw conclusions by aggregating findings from multiple

[1] Fluoride concentration levels are quoted as either parts per million (ppm) or milligrams per liter (mg/l). Readers should note that 1.0 ppm = 1.0 mg/l and that further reference to concentration levels in this report will be quoted in ppm.

[2] The Committee as ultimately constituted consisted of the four members signing this report.

studies and reports. In addition to studies the group also reviewed current public health requirements from the federal and state levels to ensure an adequate understanding of the regulatory requirements associated with fluoridation of public water supplies.

4. Primary Areas of Consideration:

The study group determined that in order to adequately address the issues raised at the September 2014 special town meeting, four primary areas should be addressed relative to water fluoridation:

Regulatory information
Health benefits and/or risks
Environmental issues
Economic information

5. Briefings made to the study group:

To gain insight into the concerns and opinions of parties for and against the use of fluoride in town water interested speakers were invited to meetings to brief the study group.

Jeffy Demeter - briefing on multiple health and environmental concerns
J. Collins, DDS, et al - briefed on oral health benefits to the community
Greg Krom (Superintendent, Topsfield Water Department) - answered study group questions on process, storage and experience related to town water fluoridation
John Coulon (Health Agent, Topsfield Board of Health) - answered study group questions on board of health experience related to town water fluoridation

In addition to the briefings, a representative from the study group spoke with the following state officials and shared the highlights with the group:

Sean Griffin, Massachusetts Department of Environmental Protection, Drinking Water Program, Northeast Regional Office
Edward Robinson-Lynch, Massachusetts Department of Public Health, Director of Primary Care and Health Access at Massachusetts Department of Public Health

6. Regulatory Information:

Fluoridation of drinking water is a program promoted by the Massachusetts Department of Public Health (DPH) under Massachusetts General Law Title XVI, Chapter 111, Section 8C. The law tasks the DPH with *recommending* methods "to reduce or limit the prevalence of dental caries and other dental diseases and defects." If the Commissioner determines that the water supply is not at the optimum level for sound dental health, the DPH Commissioner "shall so notify the local board of health of his findings." After due consideration, the local board of health "shall, if it considers doing so in the best interests of the city, town or district within its jurisdiction, order the upward adjustment of the fluoride content of the water supply... "

The DPH currently recommends fluoridating water to a level between 0.7 and 1.2 ppm, based on historic guidance from the US Department of Health and Human Services (HHS) with 1 ppm identified as the target concentration. In 2011, HHS proposed that the recommended level of

fluoride be set at 0.7 ppm, the lower end of the prior range. The proposal has not yet been formally approved and DPH has not adopted it.

The DPH has an Office of Oral Health, which among other things promotes fluoridation of drinking water. The DPH has set a goal that 80% of the population on public water receives optimally fluoridated water by 2020. As of 2012, 70% of the population has access to fluoridated water, representing 140 communities in Massachusetts.

The addition of fluoride to drinking water is not addressed under the Safe Drinking Water Act and is therefore not regulated by the United States EPA or the Massachusetts Department of Environmental Protection. The Safe Drinking Water Act does establish standards to prevent adverse effects in water supplies where fluoride is naturally occurring at elevated levels. EPA has three sets of limits for fluoride; the Maximum Contaminant Level (MCL), the Maximum Contaminant Level Goal (MCLG) and the Secondary Maximum Contaminant Level (SMCL) with the latter two being non-enforceable guidelines. MCLs are set as close to the health goals as possible, considering cost, benefits and the ability of public water systems to detect and remove contaminants using suitable treatment technologies. For fluoride, the MCL and the MCLG are both set at 4ppm because analytical methods or treatment technology do not pose any limitation. The SMCL is set at 2 ppm. Massachusetts does not have any public water supplies with naturally occurring fluoride levels that exceed the EPA limits. Therefore, the EPA standards do not affect the fluoride treatment of Topsfield's water.

Fluoridation is not required by state or federal authorities – it is a voluntary program decided at the local level. Fluoridation of the water supply in Topsfield was initiated in the 1950s. More recently, the Board of Health evaluated fluoridation in both 2008 and 2014 in response to citizen's requests and voted to continue fluoridation in both cases.

7. Findings

7.1 Health benefits and/or risks

7.1.1 Background

Fluoridation of water supplies in the United States began in the 1940s. By 1992, 144 million or 56 % of the population drank fluoridated water[3]. As of December 31, 2008, about 196 million people drank water fluoridated at or above the level recommended by the government (95% by adding fluoride and 5% with naturally occurring fluoride).[4]

7.1.2 Health Benefits

Since fluoridation began, there has been a significant reduction in the prevalence of dental caries. According to two government reports, dental health has improved in adolescents as shown on the table below.

Historic Dental Health of Adolescents Age 12 to 17

	Early 1970s[5]	1971-1974[6]	1988-1991[7]	2011[8]
Prevalence of dental caries	90%	90.4%	67%	60%
Decayed, Missing or Filled Teeth (DMFT)	6.2	6.2	2.8	2.6

Historic Dental Health of Adults

	Early 1960s (Age 35-44)[9]	1999-2004 (Age 35-49)[10]
Decayed, Missing or Filled Teeth (DMFT)	18	10

When fluoride was first introduced to the water supplies in the 1940s, it was assumed that ingested water would be the primary and likely only source of fluoride for most US residents. However, the success of fluoridated water in preventing dental caries led to the development of many products containing fluoride applied topically including toothpaste, mouthwashes and products applied at the dentist's office. By the 1990s, 90% of toothpastes available in the US market contained fluoride.[11] According to studies cited by CDC, fluoridated water accounted for 50 to 60% of the dental caries reduction in the period from 1956 to 1974, but only 18 to 40% of the reduction in 1989-1990. CDC studies determined that the reduced benefit from fluoridated water was due to the added benefit in reduced caries from topical application of fluoridated

[3] Center for Disease Control (CDC) Working Group Report: Recommendations for Using Fluoride to Prevent and Control Dental Caries in the United States, August 17, 2001 p.11
[4] Department of Health and Human Services (HHS) proposal in Federal Register to adjust fluoride concentration to 0.7 ppm; FR 1/23/2011 p.2386
[5] Ibid p.2384
[6] Op cit CDC p.11
[7] Op cit CDC p.6
[8] Op cit HHS p2383
[9] Op cit HHS p.2383
[10] Op cit HHS p.2383
[11] Op cit CDC p.14

toothpastes.[12] According to HHS, the so-called "halo" effect of beverages and food processed in fluoridated areas but consumed in nonfluoridated areas also indirectly spreads some benefit of fluoridated water to nonfluoridated communities. Nonetheless, water fluoridation is considered the most cost-effective method of delivering fluoride to all members of the community regardless of age or socio-economic standing.

7.1.3 Health Concerns

Dental fluorosis has been identified by the CDC and the American Dental Association (ADA) as the chief risk factor with fluoridated water. The ADA defines fluorosis as a disruption in enamel formation which occurs during tooth development in early childhood related to a higher than optimal intake of fluoride. Enamel formation of permanent teeth, other than wisdom teeth, occurs from about the time of birth until approximately five years of age. After tooth enamel is completely formed, dental fluorosis cannot develop even if excessive fluoride is ingested. Older children and adults are not at risk for the development of dental fluorosis. Dental fluorosis becomes apparent only after the teeth erupt.[13] Dental Fluorosis is classified according to its severity as follows[14]:

CLASSIFICATION	CRITERIA- Description of Enamel
Very mild	Small opaque, paper-white areas covering less than 25% of the tooth surface
Mild	Opaque white areas covering less than 50% of the tooth surface
Moderate	All tooth surfaces affected; marked wear on biting surfaces; brown stain may be present
Severe	All tooth surfaces affected; discrete or confluent pitting; brown stain present

The moderate and severe forms of fluorosis are rare when water is fluoridated consistent with government recommendations. However, two national surveys cited in the HHS proposal indicate that there has been an increase in the incidence for adolescents as the number of fluoridated communities increased over the last few decades.

Age 12-15	Oral health of US Children Survey 1986-1987	National Health and Nutrition Examination Survey (NHANES), 1999–2004
Overall Dental Fluorosis	23%	41%
Very mild	17.2	28.5
Mild	4.1	8.6
Moderate/Severe	1.3	3.6

The original government guidance on the appropriate concentration of fluoride in water supplies was published by the US Public Health Service in 1962 and was based on ambient air temperature of geographic areas and ranged from 0.7–1.2 ppm. The theory was that people in warmer regions drank more water and therefore a lower concentration would provide adequate benefit. Since then, studies have shown that there is no longer a significant difference

[12] Op cit CDC p.11
[13] Fluoridation Facts, American Dental Association (ADA); 2005 at p.28
[14] Ibid at p.29

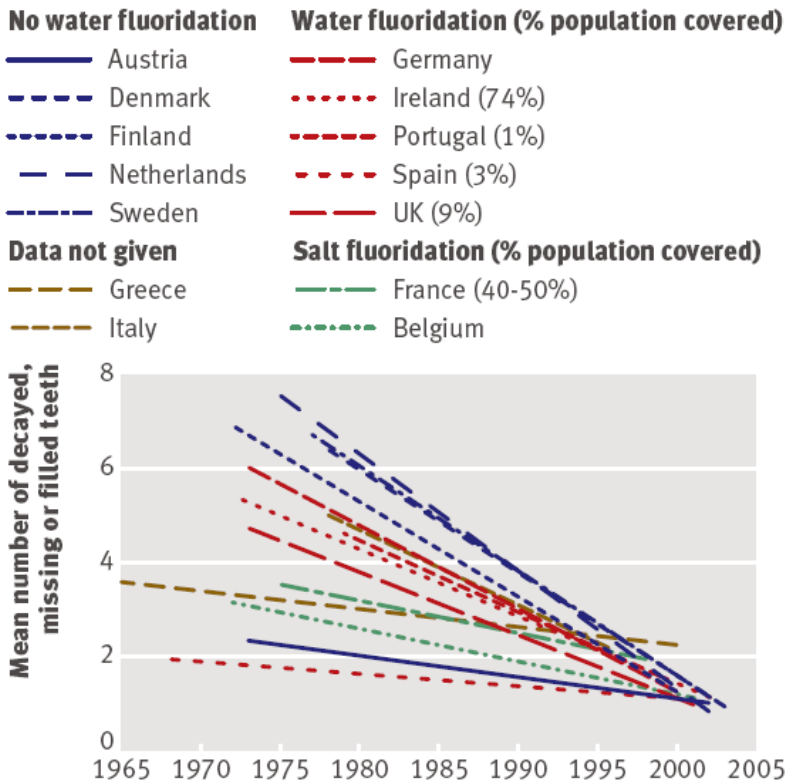
in the fluid intake among children and adolescents across geographic regions. As a result, HHS determined that a single recommended fluoridation target would be appropriate. In 2011, HHS proposed a revised recommendation of 0.7 ppm that accounts for the availability of fluoride from other sources such as toothpaste, the benefits from fluoridation, and the trends in the prevalence and risks of dental fluorosis.[15]

In 2006, at the request of the EPA, the NRC of the National Academy of Sciences issued a 530-page report entitled Fluoride In Drinking Water – A Scientific Review of EPA's Standards. It was an update of a 1993 report with the purpose of reviewing the EPA limit of 4 ppm for fluoride in light of the most recent toxicologic, epidemiologic and clinical data on fluoride. The NRC report evaluated the adequacy of the EPA 4 ppm limit on fluoride in ensuring that there are no adverse health effects related to dental fluorosis; the musculoskeletal system; reproductive and developmental systems; the nervous system and behavior; the endocrine system, gastrointestinal, renal, hepatic and immune systems; and genotoxicity and carcinogenicity. It was not a direct review of the efficacy of the CDC recommendations for artificial fluoridation then set at 0.7 ppm to 1.2 ppm. However, since the NRC report was a meta-analysis of the potential and alleged adverse health effects of fluoride in the scientific literature or raised by opponents to fluoridation, it is relevant to this discussion.

The NRC determined that the limiting health effects in terms of the concentration of naturally occurring fluoride in drinking water are musculoskeletal effects and dental fluorosis. With respect to musculoskeletal risks, the NRC concluded that EPA's limit of 4 ppm should be lowered since, compared to exposures at 1 ppm, some susceptible demographic groups (e.g. people with renal disease) may see increased fracture rates at 4ppm and higher.[16] Note that these limits are well above the recommended concentrations for fluoridated water supplies.

In contrast to the United States, the overall proportion of the population of Europe that drink artificially fluoridated water is much lower. In Europe, only Ireland and selected regions in the UK and Spain currently fluoridate drinking water at concentrations ranging from 0.8 to 1.2 ppm. Nonetheless, the dental health in European Union countries, fluoridated and nonfluoridated, has improved at a similar rate over the last five decades. Again this is attributed to topical fluoridation with toothpaste, mouth rinse and in dental clinics as well as the use of fluoridated salt and milk in some countries. The figure below is from a 2011 report by the European Commission's Scientific Committee on Health and Environmental Risks (SCHER).[17]

[15] Op cit HHS at p.2384
[16] NRC at p.352
[17] European Commission, Scientific Committee on Health and Environmental Risks (SCHER), Critical review of any new evidence on the hazard profile, health effects, and human exposure to fluoride and the fluoridating agents of drinking water, 16 May 2011



Tooth decay in 12 year olds in European Union countries[2]

SCHER acknowledges the benefits of fluoridation of water supplies but states that there could be a "narrow margin between achieving the maximal beneficial effects of fluoride and the adverse effects of dental fluorosis." The SCHER report also reviewed other potential adverse health effects and found that there was no evidence linking fluoridated water to skeletal effects, osteosarcoma, neurodevelopment or IQ, thyroid effects, human reproductive capacity. The SCHER study also concluded that there is insufficient data to evaluate the risk of bone fracture at the fluoride levels seen in areas with fluoridated water. In fact, the SCHER study cited a study indicating that fluoridation at the levels found in artificially fluoridated water may actually lower the overall bone fracture risk.[18]

The World Health Organization has established guidance for naturally occurring fluoride in drinking water of 1.5 ppm based on a consumption of 2 L water/day, and recommended that artificial fluoridation of water supplies should not exceed the optimal fluoride levels of 1.0 ppm.[19]

7.1.4 Health Effects Summary

Comprehensive analyses in this country and in Europe have concluded that drinking water fluoridated to the prescribed levels provides protection against dental caries. Both the US and European studies have also found no evidence of adverse health effects of water fluoridated at concentrations ranging from 0.7 to 1.5 ppm. Fluoridation of drinking water should be set at a level that provides adequate dental protection with minimum risks. The margin between the

[18] SCHER at p.15
[19] Ibid at p.9

beneficial effects of fluoridation and any risks, even the risks of the minor cosmetic effects of mild dental fluorosis, should be as wide as possible. The original recommendation for a fluoride concentration of 0.7 to 1.2 was made at a time when fluoride from other sources such as toothpaste was not available and it was thought that there was significant variation in the amount of water ingested in different climactic areas of the country. This is no longer the case. In addition, the Committee takes notice that the NRC 2006 meta-analysis expresses some concern over the EPA 4 ppm limit with respect to skeletal effects and that the SCHER study considers the margin to be narrow between the beneficial effects of fluoridation and the adverse effects of dental fluorosis at a fluoride concentration of 1.5 ppm. Therefore, since the HHS has proposed a fluoride concentration of 0.7 ppm and this limit would increase the margin of safety and decrease the risks of dental fluorosis, the study group believes the Town of Topsfield should adopt it.

7.2 Environmental information:

The study group did not find any issues in the literature related to detrimental environmental effects of fluoridated drinking water. Eighty percent of Topsfield residents are served by fluoridated town water, the remainder have private wells. Topsfield sewage is processed by on site septic systems. The local board of health reviews the design and installation of these systems. There is no uniform mechanism for testing wastewater for fluoride.

Sodium fluoride, which is added to the Topsfield water supply to achieve the 1.0 ppm target fluoridation concentration, is not on the list of approximately 2,000 substances on the Massachusetts Oil and Hazardous Material List, suggesting that is not considered to present a significant risk of adverse harm to the environment. Discussions with the Massachusetts Department of Environmental Protection indicated that they are not aware of any adverse environmental impacts associated with discharge of fluoridated water into the environment.

The European Commission's SCHER study reviewed the latest evidence of fluoride's health and environmental effects in 2011. The focus of the environmental risk assessment was the fluoride ion. The evaluation addressed to what extent does the fluoridation of drinking water lead to adverse ecological effects. SCHER concluded that concentrations of 0.8 to 1.5 ppm do not result in unacceptable risk to water organisms.

8. Economic information:

The town water department supplied cost information to the study group. Annually the town spends about $19,000 to administer and monitor water fluoridation. That approximate annual expense includes associated materials, equipment and labor charges. Daily manual testing requirements for fluoridation make it the most labor intensive of the four treatment systems operated by the town water department. The raw materials (sodium fluoride) are inexpensive, approximately $2,000 per year. Labor and testing supplies, such as the standards used to calibrate the testing equipment, account for about 75% of the annual cost associated with the town's water fluoridation.

9. Study Group Conclusions:
The Town of Topsfield should continue to fluoridate its drinking water supply and the concentration of fluoride should be set at a single target level of 0.7 ppm in accordance with the US Health and Human Services Department proposal. The study group believes that this will maximize protection against dental caries and minimize health risks.

Study Group Members:

John Hart, Nuclear Power Plant Engineer
(Study Group Recording Secretary)

Cheryl Jolley, Topsfield Conservation Committee, Chairperson

Gregg Demers, Massachusetts Environmental Professional Engineer
Massachusetts Licensed Site Professional

Mark Liptak, Aerospace Engineer
(Study Group Chairperson)

Reference Material Used by the Study Group:

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