

Should we continue to fluoridate our water?

Fluoride Subcommittee Report



19 May 2022

We recognize this is a controversial topic. However, decisions about safety need to be based on scientific evidence.

- The purpose of the fluoride subcommittee was not to debate whether fluoride prevents dental cavities – it does.
- **Our purpose was to review the current data to make a recommendation on the benefits vs. risks of adding fluoride to our drinking water for systemic dosing of the entire serviced population** (vs. individual topical application via fluoridated toothpaste, etc.).
- We based this review on the peer-reviewed literature only – not blogs or opinion pieces.



A brief history: why do we put fluoride in our water?

- **1942:** A physician documented the relationship between reductions in dental caries and natural fluoride exposure, and concluded that the optimal amount of fluoride to reduce tooth decay, was **1 mg per day per adult**
 - *i.e., if a person drinks 2 L of water per day, then the dosing should be **0.5 mg/L***
- **1945:** First community in USA (Grand Rapids, MI) begins fluoridating their drinking water to prevent tooth decay
- **1951:** fluoridation became an official health policy of the U.S. Public Health Service.
- **1955:** fluoride-containing toothpaste was developed but didn't become widely available in U.S. until mid-1970s



Topical fluoride is just as effective as drinking water with fluoride

- **Fluoridated water**

- Drinking water with 1 – 1.2 mg/L fluoride = **25% reduction in caries over a person's lifetime** (CDC)

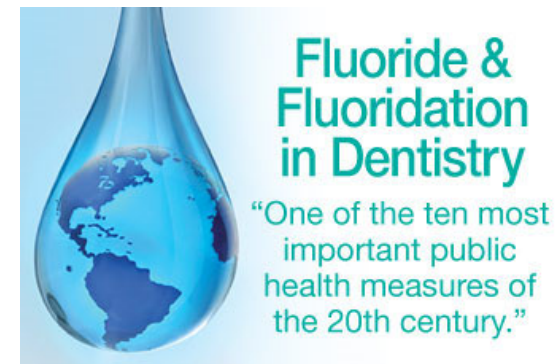
- **Topical fluoride products** (toothpastes, etc.)

- Since fluoridated toothpastes have become widely available, dramatic improvements in dental health have been observed
- Ex., 1973: 97% of 15 year olds experienced decay
2013: 42% of 15 year olds experienced decay } **55% reduction in caries**

What does the American Dental Association (ADA) recommend?

- The ADA supports levels of **0.7 – 1.2 mg/L** for preventing tooth decay
 - Cited benefits: Reduces dental caries by 25 – 50% in primary and permanent teeth
 - *Note: Most of the research on fluoride in preventing dental caries was conducted before 1980 and does not take into account the dramatic improvements in dental health as a result of topical fluoride products.*
- In 2006, the ADA began recommending that **infants (0 – 12 months) should have their formula prepared with water that is fluoride free** to reduce the risk of fluorosis*

**Fluorosis = fluoride poisoning: discoloration and pitting of the teeth; at > 8 mg/L may cause replacement of bone calcium with fluorine, weakening the bone, resulting in bone brittleness, joint stiffness, tendon calcification, and osteosclerosis.)*



What does the U.S. Department of Health and Human Services (HHS) recommend?

- Although the HHS originally agreed with the ADA for optimal fluoridation between 0.7 – 1.2 mg/L to prevent tooth decay, they reduced this to **0.7 mg/L***
 - Goal: to prevent tooth decay while minimizing dental fluorosis

*This is consistent with Health Canada



U.S. Department of
Health and Human
Services



What does the U.S. Food and Drug Administration (FDA) recommend?

- 2022: The FDA issued its final rule that fluoride in bottled water may not exceed **0.7 mg/L**.
 - **Must be declared on the ingredient list** so consumers can determine whether fluoride has been added.
- The FDA does not regulate the concentration of fluoride in tap water, because tap water falls under the jurisdiction of the EPA

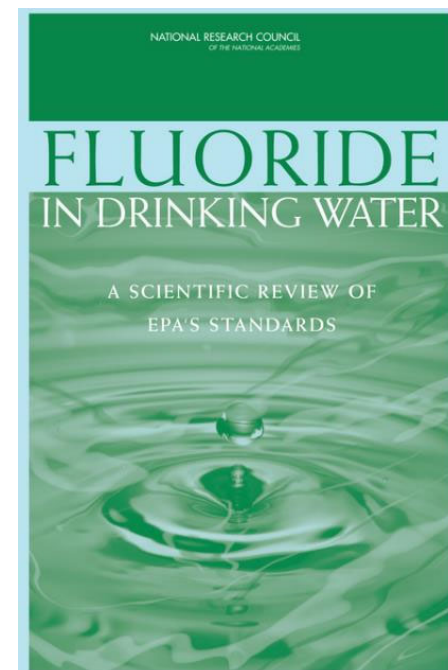


What does the Environmental Protection Agency (EPA) legally require?

- The 1986 amendments to the U.S. Safe Drinking Water Act state:
“no primary drinking water regulation may require the addition of any substance for preventative health care purposes unrelated to contamination of drinking water”
- In 1986, the EPA also stated that **if home fluoride levels exceed 2 mg/L, children should be given alternative sources of water.**
- In 2003, the EPA asked that the National Research Council (NRC) of the National Academies of Science conduct a review of the data

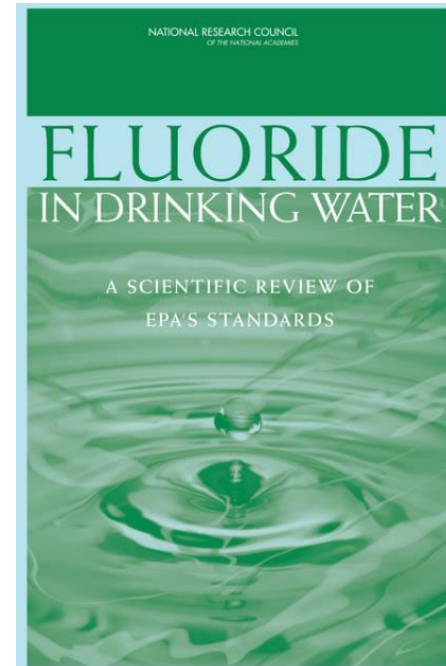
What does the National Research Council recommend?

- In 2006, the National Research Council published *Fluoride in Drinking Water: A Scientific Review of EPA's Standards*.
 - Download for free:
<https://nap.nationalacademies.org/read/11571/chapter/1>
- Some key points of this report include:
 - There is scientific evidence that fluoride can weaken bone and increase the risk of fractures, particularly above 4 mg/L as compared to 1 mg/L.
 - While severe enamel fluorosis is nearly zero at fluoride below 2 mg/L, this concentration does not completely prevent the occurrence of moderate enamel fluorosis (discoloration of front teeth).
 - The degree to which moderate enamel fluorosis might go beyond a cosmetic effect to create psychological, behavioral, and social effects is not known.



What does the National Research Council recommend (continued)

- Additional studies should examine the prevalence and severity of enamel fluorosis for fluoride greater than 1 mg/L.
- **The EPA should update its fluoride risk assessment** to include new data on health risks and better estimates of total exposure.
- **The EPA should update its public health goal** to be protective of pitting of tooth enamel, clinical stage II skeletal fluorosis and bone fractures, in addition to the stage III skeletal fluorosis that is addressed by the current public health goal.



What has the EPA done since the NRC report?

- In 2010, the EPA reported that **data indicate that fluoride exposure levels among the population have increased in the last 40 – 50 years**, resulting in an increase in some negative effects on teeth.
 - The increase in fluoridated water for commercial production of beverages and solid foods has likely resulted in increased dietary fluoride, adding to the risk for over-exposure.
 - **It is likely that some children (ages 8 and younger) are exposed to too much fluoride at least occasionally** while their teeth are forming because of their high fluid intake relative to their body weight and/or because of high natural levels of fluoride in their local drinking water.
- **At this time, the EPA plans to review the new data, but has not yet made a decision about revising the drinking water standard for fluoride.**

Who decides if water is fluoridated or not in the USA?

- Artificial fluoridation decisions are made at the state and local levels.
- Pennsylvania does not require a minimum fluoride concentration in drinking water.



What is the history of fluoride dosing by the SCBWA?

- 1950: SCBWA met with State College Dentists and Physicians Society
 - **Note: this was prior to fluoride toothpaste being widely available**
- 1954: Fluoridation at SCBWA began at **1 mg/L**
- Current operational goal is to maintain a fluoride residual of **0.7 – 1 mg/L**
 - Average fluoride residual in the SCBWA water:
 - 2017: 0.60 mg/L
 - 2018: 0.54 mg/L
 - 2019: 0.91 mg/L
 - 2020: 0.76 mg/L
 - 2021: 0.78 mg/L
 - Five year average (2017 – 2021) = **0.69 mg/L**
 - *This average is close to the current HHS recommendation of 0.7 mg/L*
 - The highest daily residual over this same time period = **1.52 mg/L**

While we wait, what is happening to our children?

- Recall that in 2006, the ADA began recommending that **infants (0 – 12 months) should have their formula prepared with water that is fluoride free** to reduce the risk of fluorosis*
 - This is because the percentage of dental fluorosis in US children age 12 to 15 increased from 23% (1986-87) to 41% (1999 – 2004)
 - 96% of children in USA now use toothpaste (the majority is fluoridated)
- Many studies have indicated **prenatal fluoride exposure is associated with lower IQ**
 - In the most recent study, researchers found that children exposed to artificial fluoridation before birth had significantly lower IQ scores (Green et al., 2019, *JAMA Pediatrics*).
 - Fluoridation was in Canada at 0.7 mg/L
 - **The findings suggest that fluoride ingestion during pregnancy, within the normal range of water fluoridation standards, may affect children in utero.**



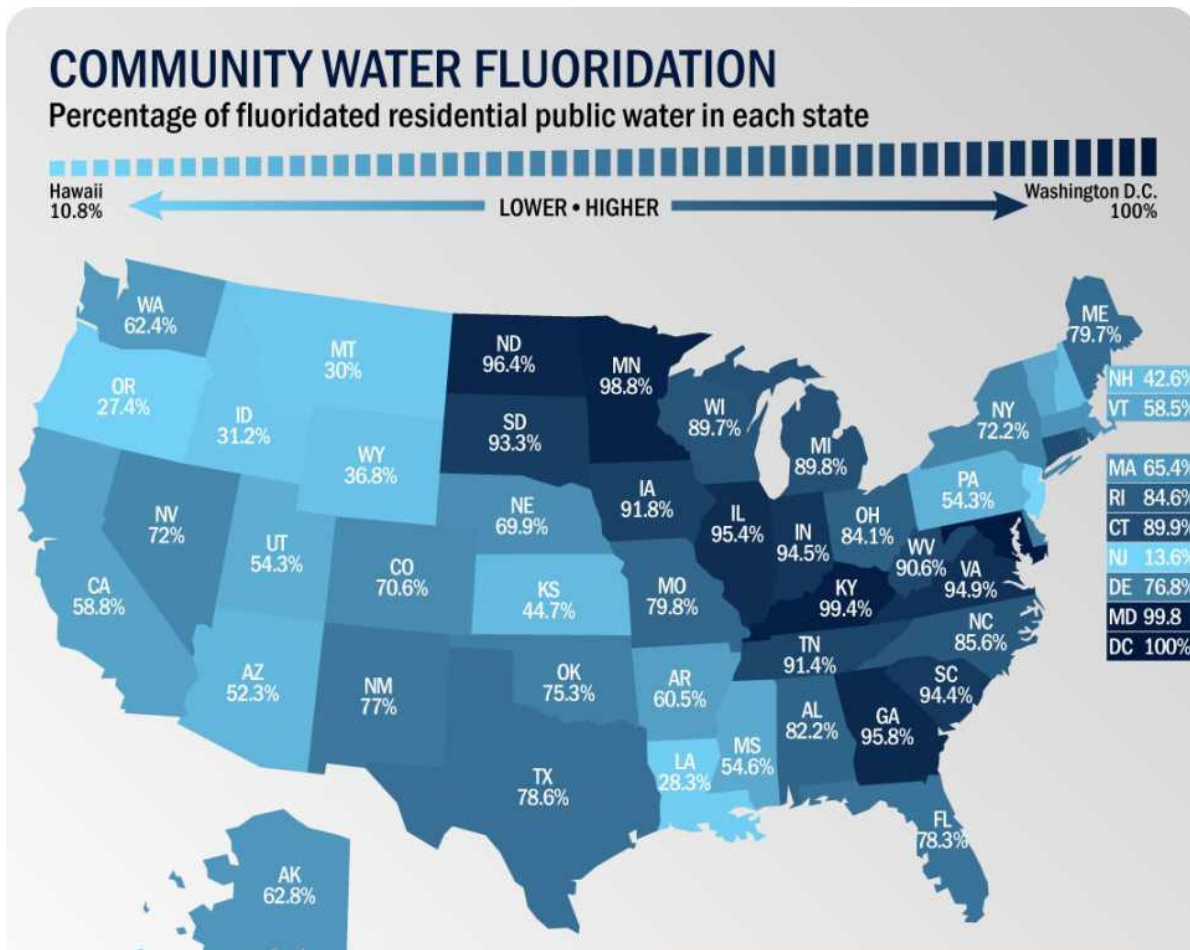
How can I take fluoride out of my water if I don't want it?

- **Answer: you probably can't.**
 - **Fluoride cannot be removed by boiling or home carbon filtration**
- Expensive methods to remove fluoride from drinking water:
 - Reverse osmosis
 - Specialty ion exchange resins

Is artificial fluoridation used elsewhere?

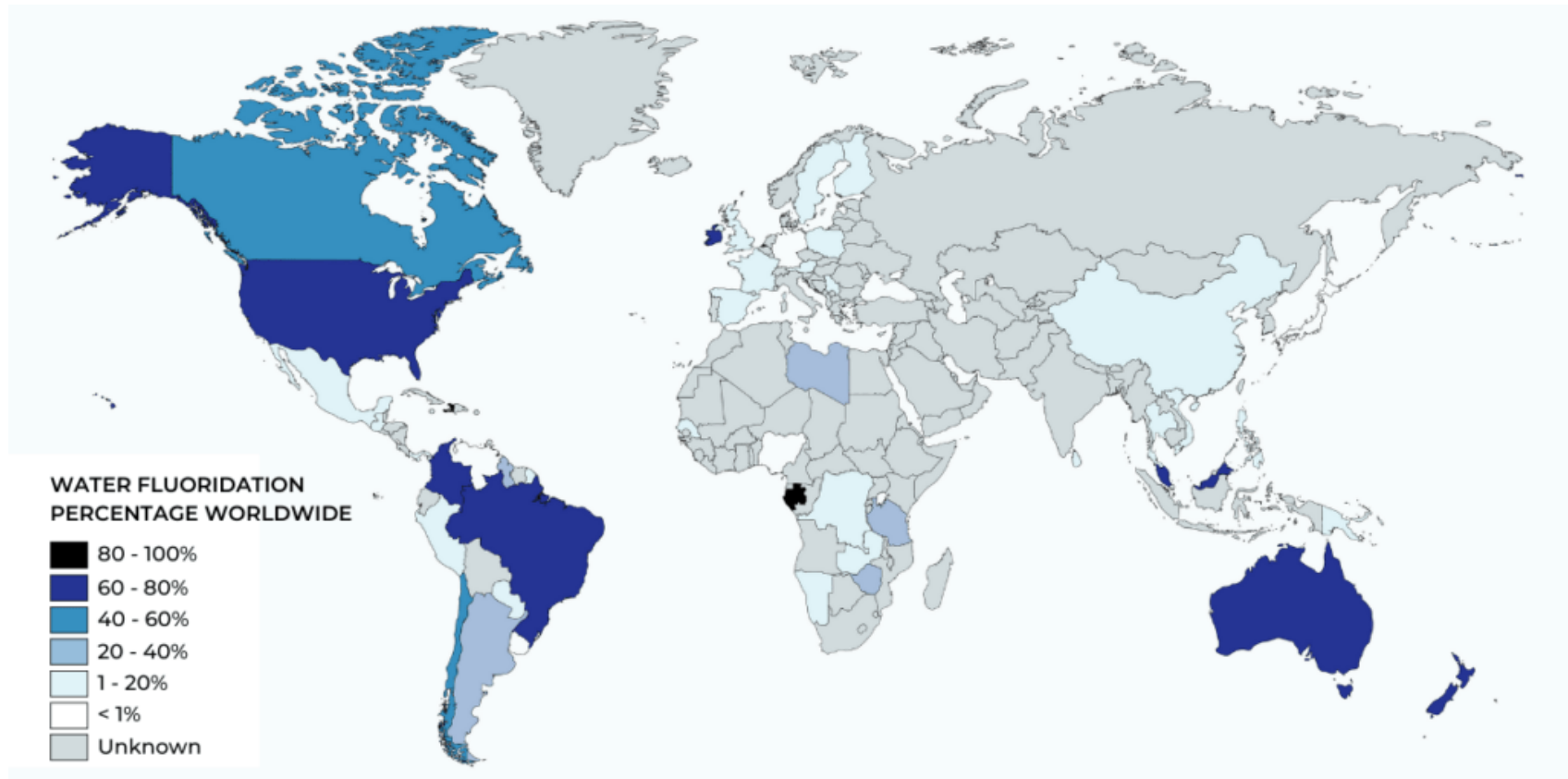


Approximately 2/3 of the US population drinks fluoridated water



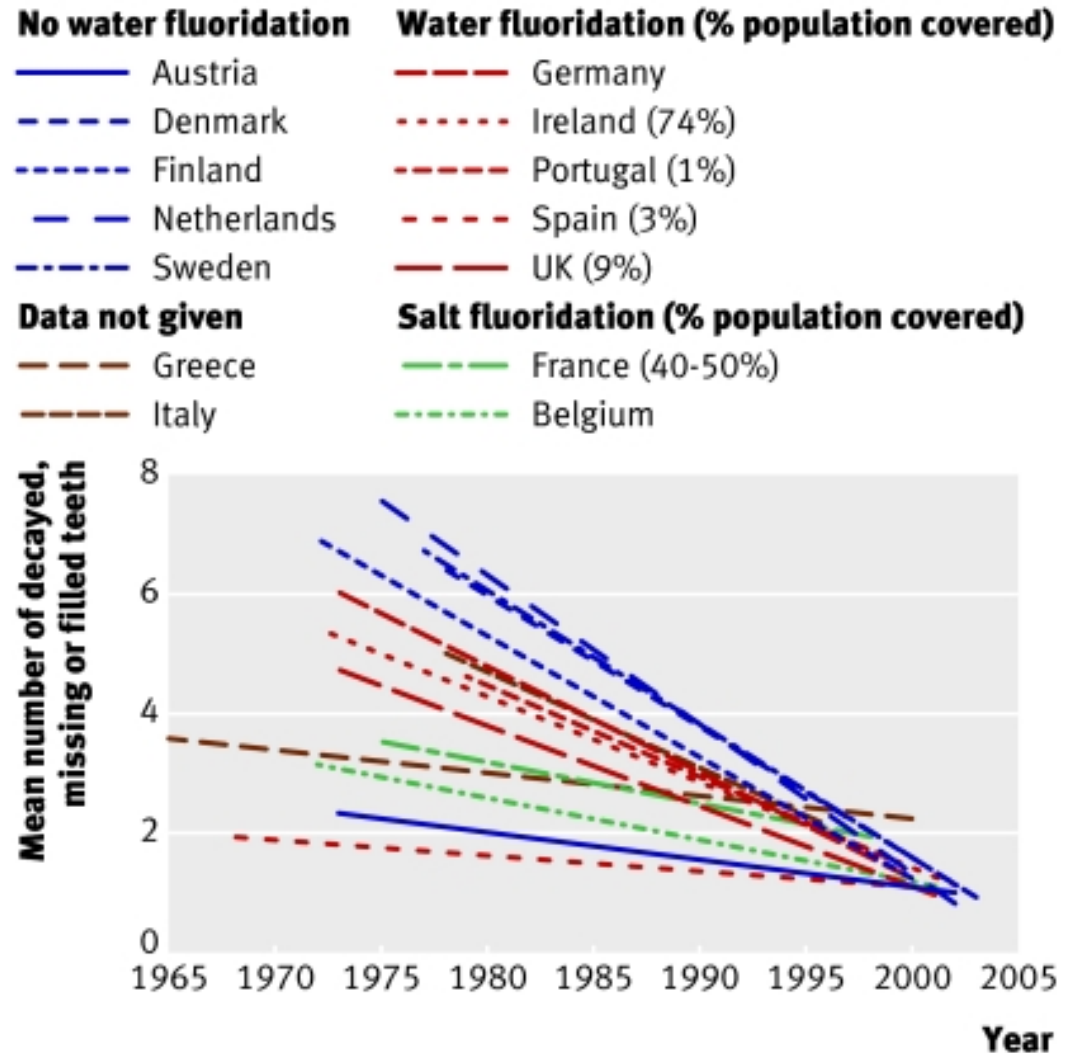
Note: From 2013 - 2018, 74 cities removed fluoride from their drinking water, including Bellefonte, PA.

Worldwide, 5.7% of people receive drinking water containing up to ~1 mg/L fluoride



Let's take a closer look at Europe...

- **97% of western Europe drinks non-fluoridated water**
- Despite this, **tooth decay rates in Europe have declined over the past 50 years just as they have in the USA**
 - Likely due to education on oral hygiene (fluoridated toothpastes, etc.)
 - **This indicates water fluoridation plays a relatively minor role in the improvement of dental health**



Cheng et al., 2007, BMJ.

European Health, Water, & Environment Authorities do not accept potential side effects so that a minority may benefit.

- **Switzerland:** discontinued fluoridation after 41 years because other measures were of “comparable effectiveness” to “compulsory medication”
- **Belgium:** “...the fundamental position of the drinking water sector ...is not...to deliver medicinal treatment to people.”
- **Finland:** “We do not favor or recommend fluoridation of drinking water. There are better ways of providing the fluoride our teeth need.”
- **France:** “Fluoride chemicals are not included in the list of chemicals for drinking water treatment. This is due to ethical as well as medical considerations.”
- **Germany:** “Generally, in Germany, fluoridation of drinking water is forbidden. The argument of the Federal Ministry of Health against a general permission of fluoridation of drinking water is the **problematic nature of compulsory medication.**”
- **Norway:** “...we had a rather intense discussion on this subject some 20 years ago, and the conclusion was that drinking water should not be fluoridated.”

Is fluoride a medicine?

- The FDA defines a medicine as “a substance intended for use in the diagnosis, cure, mitigation, treatment, or prevention of disease. A substance (other than food*) intended to affect the structure or any function of the body.”
- If fluoride is a medicine, evidence on its effects should be subject to the standards of proof expected of drugs (including evidence from randomized trials).

**The US Food and Nutrition Board found the data insufficient to derive estimated average requirements for fluoride.*

Ethical implications

- Under the **principle of informed consent**, anyone can refuse treatment with a drug or other intervention
- Health interventions can only be carried out after free and informed consent
- People have a right to decide whether or not to undergo medical intervention even if refusal may result in harm.

The cost and risk of artificial fluoridation

- **Cost:** In 2019, the SCBWA budgeted **over \$70k/yr** for the purchase of sodium fluoride as well as equipment maintenance, labor, and analysis.
- **Risk:** Generally, **up to a full year's supply of sodium fluoride is stored at the Woodside Drinking Water Treatment Plant.**
 - The Material Safety Data Sheet for sodium fluoride states:
 - **Danger!***
 - Causes irritation and possible burns by all routes of exposure.
 - May be fatal if swallowed
 - Contact with acids liberates toxic gas
 - May cause lung damage
 - Moisture sensitive

**Although these hazards generally only apply to our operators who are handling high concentrations of the chemical, if there was an accident and larger masses got into our distribution system, more of the public could potentially be at risk.*

The majority of added fluoride is wasted

- Only a small percentage of the fluoride that is added to the SCBWA's typical 5 million gallon/day production rate is actually consumed by the public
 - ~2L out of 67 gal/person-day is ingested by our 75,000 residents, or 0.8%
 - This means that **99.2% of the added fluoride is wasted.**
- The wasted fluoride is ultimately released into the environment
 - Elevated fluoride in freshwater is dangerous to aquatic life and can be damaging to soil chemistry, microbiology, and plants (MSDS sheet).
- Since sodium fluoride is manufactured through a chemical reaction and transported across the country, there is pollution related to its synthesis, transportation, etc.

Let's review the mission of the SCBWA:

“The goal of the State College Borough Water Authority is to provide the Centre Region with an excellent supply of potable water at the lowest possible cost, and to provide top-quality service to our customers.”

- **In other words, the mission of the SCBWA is to provide safe water, not medicate the public.**

Summary of findings:

- **There is no obvious advantage of water fluoridation compared with topical prevention for the prevention of dental caries.**
- **Pregnant women and babies should not drink fluoridated water**
 - **Potential IQ loss**
 - **Dental fluorosis**
- **The general population has no way of removing fluoride from their water if they don't want it**
- The addition of fluoride to drinking water increases cost and introduces risk

The committee's recommendation is to follow the Precautionary Principle

- *When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause and effect relationships are not fully established scientifically.*
- In this context, the proponent of an activity, rather than the public, should bear the burden of proof.
- **We recommend (2:1) to cease fluoridating our finished water and follow the precautionary principle until such time as more compelling safety and efficacy data are available.**

Noteworthy references

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