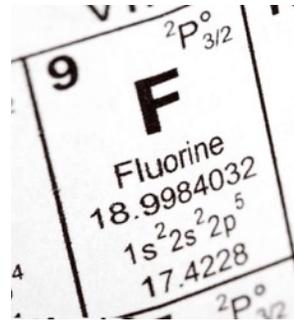


What is Fluoride?

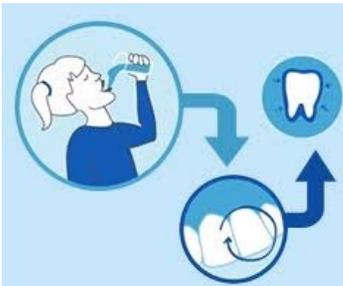
Fluoride is an organic and inorganic compound that contains elements of fluorine. It is formed when salts from fluorine combine with minerals in soil or rocks. The four types of fluorides most present in the environment are hydrogen fluoride (HF), calcium fluoride (CaF₂), sodium fluoride (NaF), and sulfur hexafluoride².

Where is Fluoride found?

Fluoride is found in the environment from weathering, volcanic and marine emissions, and the dissolution of minerals¹. Humans produce fluoride through industrial processes such as steel manufacture, phosphate ore processing, coal combustion, glue and adhesive production, and phosphate fertilizer productions⁷. The compound is commonly used in dental preparations such as mouthwashes, tablets, toothpaste, varnishes, and gels¹. It is also used to control fluoridation of drinking-water supplies to prevent dental caries (cavities). Fluoride levels are usually lower in meat and vegetables, and higher in the bones of fish and seafood like salmon and sardines.



Exposure and Absorption



- Soluble fluorides (found in dental products) are immediately absorbed by the gastrointestinal tract¹
- 99% of total body burden of fluoride is in bones and teeth⁷
- Fluoride crosses placenta from mother to fetus, leading to infants retaining 80%-90% from the mother⁴
- Fluoride is eliminated by the body through urine
- Soluble fluorides bioaccumulate in certain aquatic and terrestrial biota⁵
- Terrestrial plants accumulate fluorides through airborne deposition and soil uptake⁵

Animal and Human Health Hazards



- Minimal oral dose to produce signs of acute fluoride intoxication: 1 mg/kg/bw
- Studies in China and India suggest that skeletal fluorides and increased risk of bone fracture occur at total fluoride intakes of 14 mg/day and increased risk of bone effects at 6 mg/day²
- Lowest concentration of fluoride to cause dental fluorosis in dairy cattle is 30 mg/kg feed or 2.5 mg/litre drinking water, and for white-tailed deer it is 35 mg/kg⁴

Human Health Outcomes³

Long-term ingestion of drinking-water health effects: skeletal/dental fluorosis, and increased bone fractures²

Inhalation Exposure: increased risk of lung and bladder cancer, and irritation of respiratory tract

Acute effects of ingested fluoride: abdominal pain, excessive saliva, nausea, vomiting, seizures, and muscle spasms

Animal Health Outcomes²

Lowered milk production in milk-producing mammals

Stiffness of joints

Abnormal teeth and bones

Emaciation

Problems with reproductive systems

Environmental Risks

- Aquatic organisms may experience adverse effects due to pollution of their environment from manmade discharges of fluoride
- Terrestrial plant communities are at risk if they are near fluoride-emitting sites²
- Soils easily uptake fluoride in the environment, which then is absorbed by plants and organisms³
- Fluoride-contaminated pasture and soil with long-term use of phosphate fertilizers²



QUICKFACTS⁶

PROPONENTS

Decreases decay by 25% "over good oral health habits alone."

A recent study of U.S. adults found that those born in counties with fluoridation lose fewer teeth than those born in fluoride deficient countries.

Nearly 40% of Coloradans don't have dental insurance.

Cost to fluoridate is \$1 - \$3 per person, per year.

OPPONENTS

You can't control the dose of fluoride people get.

One Lafayette citizen says she spends almost \$10,000 in cosmetic dentistry every 8 - 10 years because of fluorosis.

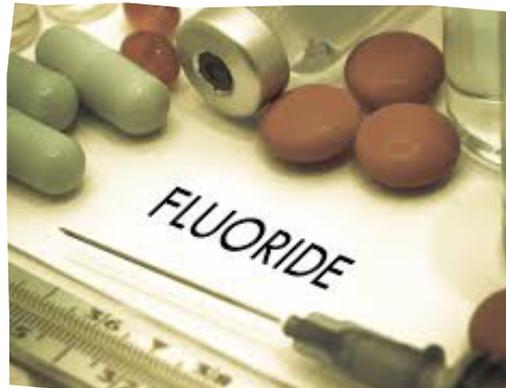
Most European countries have rejected artificial, en masse water fluoridation.

The percentage of dental fluorosis in U.S. children age 12 - 15 increased from 23% (1986 - 87) to 41% (1999 - 2004).



Uncertainties and Data Gaps

- Natural quantities of fluoride in water geographically varies according to environment and added fluoride¹
- Difficulty identifying causal relationship due to multiple exposure pathways such as food, air, and water⁷
- Limited research conducted on biomagnification of fluoride in aquatic or terrestrial food chains⁵
- Amount of natural fluoride complicates standardized amounts for fluoridation³
- Little studies on dose-response relationships
- Uncertainty over affect of fluoride-intake on human health because ingestion is affected by other substances (aluminum, phosphorous, magnesium, and calcium)⁷



What are the regulations surrounding fluoride?

In 1962, the US Public Health Service (PHS) recommended fluoridated drinking-water, ranges from 0.7 to 1.2 mg/liters, to prevent tooth decay⁴. In 2015, the amount was changed to 0.7mg/litre to take into account fluoride in toothpaste. The US Center for Disease Control (CDC) states that the optimal amount of fluoride in drinking-water to most effectively combat tooth decay is 0.7 mg/liter¹. The EPA set a maximum amount of fluoride in drinking-water to 4.0 mg/litre, and no more than 2.0 mg/litres for children. Dental products and bottled water containing fluoride are regulated by The US Food and Drug Administration (FDA)⁵.

Conflicts of Interest³

Community water fluoridation is funded by organizations like American Dental Association, American Academy of Pediatrics, US Public Health Service, and World Health Organization. Many fluoride-selling pharmaceutical companies such as Colgate, Johnson & Johnson, and GlaxoSmithKline also support water fluoridation efforts. Conflicts arise because pharmaceutical companies arguably benefit from tooth decay and dental product sales, brought to attention from financial support between organized dentistry and industry). The EPA also conducts research and determines standards for safe drinking water, however decisions to fluoridate water are made at the local/state level.

Alternatives²

- Bottled non-fluoridated water
- Fluoride-free dental products
- Consuming more organic and pesticide-free produce
- Salt or milk fluoridation (instead of fluoride) to prevent dental caries



Footnotes

1. The American Cancer Society medical and editorial content team. "Water Fluoridation and Cancer Risk." American Cancer Society, American Cancer Society, 28 July 2015, www.cancer.org/cancer/cancer-causes/water-fluoridation-and-cancer-risk.html.
2. American Chemistry Council. "Fluoride." ChemicalSafetyFacts.org, ChemicalSafetyFacts.org, 22 Sept. 2017, www.chemicalsafetyfacts.org/fluoride/.
3. "Fluoride." GreenFacts: Facts on Health and the Environment, GreenFacts Scientific Board, 15 Apr. 2005, www.greenfacts.org/en/fluoride/fluorides-3/03-fluoride-exposure.htm#4p0.
4. "Inadequate or Excess Fluoride: A Major Public Health Concern." World Health Organization, World Health Organization, 2010, www.who.int/ipcs/features/fluoride.pdf?ua=1.
5. Liteplo, R, et al. "FLUORIDES." FLUORIDES, International Programme on Chemical Safety, 2002, www.inchem.org/documents/ehc/ehc/ehc227.htm#1.0.
6. MacNeal, David. "Lafayette's Fluoride Frenzy." Yellow Scene Magazine Lafayettes Fluoride Frenzy Comments, Yellow Scene Magazine, 18 June 2013, yellowscene.com/2013/06/18/lafayettes-fluoride-frenzy/.
7. World Health Organization. "Guidelines for Drinking-Water Quality: Fourth Edition Incorporating the First Addendum." Water Sanitation Hygiene, World Health Organization, 2017, apps.who.int/iris/bitstream/10665/254637/1/9789241549950-ena.pdf?ua=1.