



Association of State and Territorial Dental Directors Fact Sheet

Naturally Occurring Fluoride in Drinking Water

Prepared to assist State and Territorial Oral Health Programs and their stakeholders in providing answers to common questions about fluoride occurring naturally in private wells and groundwater.

How much fluoride is found naturally in drinking water sources?

Fluoride is present in all water sources at concentrations ranging from minimally detectible to greater than 10 parts per million (ppm). The fluoride level in rivers and lakes (surface water) varies widely, reflecting rainwater contact with windblown soils and other elements in the environment. Well water (groundwater) fluoride levels vary depending on the minerals in the rock and ores that the water passes over. Fluoride in ocean water is typically in the range of

1.2 to 1.4 ppm. Water sources with high fluoride concentrations have been found in many parts of the world, including in the

Parts per million (ppm) is the same as milligrams per liter (mg/L). One ppm is comparable to one inch in 16 miles.

US.^{1,2} A small percentage of U.S. community water systems have drinking water that naturally exceeds 2 ppm of fluoride and a smaller percentage have water that exceeds 4 ppm.³ When public water systems have levels above the US Environmental Protection Agency's (EPA) established maximum contaminant level (MCL) of 4 ppm, they are required to use measures to reduce the level to below 2 ppm to protect children against tooth discoloration/pitting (dental fluorosis).⁴

Fluorine, the 13th most abundant element in the earth's crust, is widely dispersed in nature, entirely in the form of fluorides.

How did we learn that fluoride in drinking water helps prevent tooth decay?

Water samples from Colorado, analyzed in the early 1900s when fluoride's benefits were discovered, demonstrated the association between Colorado children with yellow/brown stains and lower incidence of tooth decay. The levels of fluoride naturally occurring in the water ranged from 2 to 13.7 ppm fluoride.⁵ These studies resulted in understanding that exposure to fluoride in drinking water protects against tooth decay. It is important to note that staining or severe dental fluorosis does not occur at the optimal level of fluoride, 0.7 ppm, that provides this protection.

Who is responsible for monitoring fluoride found naturally in public/community water systems?

The Safe Drinking Water Act (SDWA) designated the EPA as the lead agency responsible for safe levels of substances in drinking water, including naturally occurring fluoride. The EPA sets regulatory standards for the quality of public drinking water systems, defined as water systems with 15 or more service connections serving an average of 25 persons daily for at least 60 days in a year (for example, parks and recreational areas). The SDWA defines *any* physical, chemical, biological or radiological substances or matter in drinking water as "contaminants" regardless of the effect or level of the substance on human health. Drinking water contains small amounts of many different substances below the identified regulatory safe level. EPA considers scientific literature on health effects of all regulated substances, establishes a maximum level in drinking water to protect against adverse health effects, and works with designated regulatory agencies in states to monitor and enforce these levels.⁶

Who is responsible for monitoring fluoride found naturally in private drinking water sources?

Approximately 12 percent of US residents rely on private wells not regulated by the EPA.⁷ Private groundwater wells serving fewer than 15 connections or fewer than 25 persons for no more than 60 days in a year are not regulated. The well owner is responsible for knowing the quality of the water and whether it is suitable for human consumption. The US Geological Survey (USGS), the science agency for the US Department of the Interior, found that 23 percent of private

¹ World Health Organization. [Fluoride in Drinking-water](http://www.who.int/water_sanitation_health/publications/fluoride_drinking_water/en/). pp: 5-8.2006. http://www.who.int/water_sanitation_health/publications/fluoride_drinking_water/en/

² Petersen PE, Lennon MA. [Effective use of fluorides for the prevention of dental caries in the 21st century: the WHO approach](https://doi.org/10.1186/14752875). Community Dent Oral Epidemiol. 2004;32:319–21.

³ National Academies Press. [Fluoride in Drinking Water: A Scientific Review of EPA's Standards](https://doi.org/10.17232/consumer.2006.2.25). 2006;2:25.

⁴ US Environmental Protection Agency. Questions and Answers on Fluoride. (2011) https://www.epa.gov/sites/default/files/2015-10/documents/2011_fluoride_questionsanswers.pdf

⁵ Churchill, HV. [Occurrence of Fluorides in Some Waters of the United States](https://doi.org/10.1002/1522-2675(193109)23:9%3C996::AID-CELE996%3E3.0.CO;2-1). Industrial and Engineering Chemistry. Sept 1931. 23(9)996-8.

⁶ US Environmental Protection Agency. [Drinking Water Regulatory Information](https://www.epa.gov/dwreginfo/drinking-water-regulatory-information). <https://www.epa.gov/dwreginfo/drinking-water-regulatory-information>

⁷ US Geological Survey. Updated Information on Locations of Domestic Well Use, [Updated Information on Locations of Domestic Well Use](https://www.usgs.gov/locations-of-domestic-well-use) | [U.S. Geological Survey \(usgs.gov\)](https://www.usgs.gov/)

wells exceeded the identified regulatory safe level for one or more contaminants at a level indicating a potential health concern.⁸ These substances were primarily radon, arsenic, uranium, manganese and nitrates. This compares to one percent of wells with fluoride levels high enough to be of concern.

How often should private wells be tested, and why?

Private well owners should test their wells for drinking water contaminants of significant health concern at intervals recommended by state drinking water or environmental/natural resources agencies. Recommendations vary by state, but most suggest that fluoride should be included every three to five years to monitor naturally occurring levels.^{9,10}

If the naturally occurring fluoride in drinking water is not adequate (optimal) for decay prevention, and the water supply cannot be fluoridated, fluoride supplements (prescription tablets or drops) may be recommended for children at risk for tooth decay.^{11,12} Health professionals need to know when the fluoride level in drinking water is less than the recommended level before prescribing fluoride supplements for children.

What are the recommended levels for fluoride in drinking water sources?

The EPA has set maximum allowable concentrations of fluoride in drinking water at 2 ppm to prevent enamel fluorosis and 4 ppm to prevent skeletal fluorosis.¹³ Four ppm (4 ppm), the MCL, is enforceable by the EPA, meaning that the EPA does not allow water with that level as a routine drinking water source. SDWA requires public notification when the level is greater than 2 ppm, the secondary MCL. In addition, states may set their own standard for the lower MCL.

The US Public Health Service (USPHS) recommends 0.7 ppm as the optimum level of fluoride in drinking water for reducing the risk of tooth decay, and is low enough to reduce the risk of [mild enamel fluorosis](#). At the recommended level of 0.7 ppm, there are no adverse health effects. More than 117 organizations including the US Centers for Disease Control and Prevention, the American Dental Association, the American Water Works Association and the Association of State and Territorial Dental Directors encourage the adjustment of the naturally occurring fluoride level to meet the optimal concentration for preventing dental decay.

Can water filtration systems reduce or remove excessive fluoride from drinking water?

[NSF Standard 58](#) recommends that defluoridation devices achieve at least an 80 percent fluoride removal rate to be considered adequate.¹⁴ Removal of fluoride from water is difficult and expensive for community water systems or private wells. Reverse osmosis devices and water distillation can effectively remove fluoride. Activated carbon filtration units sold for home use do not remove fluoride.

RESOURCES

Recognized and reliable sources for scientifically accepted information include:

[Centers for Disease Control and Prevention Oral Health](#)

- [Private Well Water and Fluoride, Community Water Fluoridation, and Safety and Effectiveness of Community Water Fluoridation](#)

[National Research Council](#)

[U.S. Preventive Services Task Force](#)

[American Dental Association Fluoridation resources](#)

- [Fluoridation Facts; Fluoride Supplements](#)

[Water Systems Council \(fact sheets\)](#) (See: [Fluoride & Well Water](#), [Well Water & Children's Health](#), and [Well Water Testing](#))

[National Groundwater Association](#) and [fluoride](#)

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⁸ US Geological Survey. USGS Water Science School. Contamination in US Private Wells, 2009. <http://water.usgs.gov/edu/gw-well-contamination.html>

⁹ US Centers for Disease Control. Healthy Water. Well Testing. <https://www.cdc.gov/healthywater/drinking/private/wells/testing.html>

¹⁰ Protect Your Home's Water. US Environmental Protection Agency. <https://www.epa.gov/privatewells/protect-your-homes-water#welltestanchor>

¹¹ Association of State & Territorial Dental Directors. Fluoride Supplement Policy Statement. <http://www.astdd.org/docs/fluoride-supplement-policy-statement-january-28-2013.pdf>

¹² US Preventive Services Task Force; Davidson KW, Barry MJ, Mangione CM, et al. Screening and interventions to prevent dental caries in children younger than 5 years: US Preventive Services Task Force Recommendation Statement. JAMA. 2021 Dec 7;326(21):2172-2178. doi: 10.1001/jama.2021.20007. PMID: 34874412.

¹³ US Environmental Protection Agency. Questions and Answers on Fluoride. (2011) https://www.epa.gov/sites/production/files/2015-10/documents/2011_fluoride_questionsanswers.pdf

¹⁴ A copy of the NSF/ANSI Standard 58 can be ordered from the website, <http://www.nsf.org/regulatory/regulator-nsf-standards> (Founded in 1944 as the National Sanitation Foundation and now known as NSF International, NSF follows the American National Standards Institute (ANSI) standards development process to develop standards and to test and certify products and systems that help protect the world's food, water, consumer products and environment.)