33 Whittemore Farm Rd., Swanzey, NH 03446
Phone: (603) 357-2577 / Toll Free: (800) 760-4246
Fax: (603) 352-3899
Email: chem@eai-labs.com

Fluoride in Drinking Water[1]

Fluoride occurs naturally in New Hampshire's bedrock. As such, it is frequently present in water samples taken from bedrock (artesian drilled) wells. Fluoride is seen at high concentrations in the Mt. Washington-Saco River Valley area, Wolfeboro through Franconia Notch and immediately west of Concord. In the remainder of New Hampshire, high fluoride concentrations occur in bedrock well water more irregularly. Fluoride has no taste, color or odor and **thus the only way** to determine its concentration is by laboratory analysis.

In dug wells that are excavated into sand and gravel and are typically 15' deep and 3' in diameter, the fluoride level is generally very low (<0.1mg/L) and would not be expected to exceed 2 mg/L.

HEALTH AFFECTS

Fluoride in drinking water is beneficial at low concentrations, but presents health concerns at higher concentrations. There are many sources of fluoride in the diet. Dentists apply fluoride to teeth; some municipal water systems add fluoride to the water supply; and some toothpastes have fluoride as an additive; and some foods also have elevated fluoride such as fish and tea.

The Centers for Disease Control (CDC) have recommended 1.0 to 1.2 milligrams per liter (mg/L) as the optimum beneficial concentration of fluoride in drinking water for dental protection in state of New Hampshire.

At higher concentration however, there are health concerns. The US EPA has developed standards that limit the presence of fluoride in public drinking water supplies. These health standards are called maximum contaminant levels (MCLs). In addition, there are non-health related standards (that relate to aesthetics) called secondary maximum contaminant levels (SMCLs) which pertain to fluoride. These important ranges of fluoride in drinking water are explained below.

Fluoride concentration of approximately 1.1 mg/L

Fluoride has been shown to reduce tooth decay in children if they receive an adequate level. The optimal concentration, as recommended by CDC for New Hampshire, is approximately 1.1 mg/L. (1.1 mg/L is the same as saying 1.1 parts per million parts (ppm)). Below 0.5 mg/L there is little tooth decay protection. Above 1.5 mg/L, there is little additional tooth decay benefit.

Fluoride concentration over 2.0 mg/L

In the range of 2.0-4.0 mg/L of fluoride, staining of tooth enamel is possible. EPA categorizes staining as an aesthetic concern, and thus only requires that customers of public water systems be notified of the elevated fluoride level. EPA does not require fluoride removal when the concentration exceeds 2.0 mg/L

1. The material contained in this fact sheet was excerpted from the New Hampshire Department of Environmental Services web site (http://www.des.state.nh.us/ws.htm).

but is less than 4.0 mg/L. Approximately 5% of New Hampshire bedrock wells have fluoride that exceeds 2.0 mg/L.

Fluoride concentration over 4.0 mg/L

At concentrations above 4.0 mg/L, studies have shown the possibility of skeletal fluorosis as well as the staining of teeth. In its most severe form, skeletal fluorosis is characterized by irregular bone deposits that may cause arthritis and crippling when occurring at joints. EPA recognizes skeletal fluorosis as a health concern, and thus requires that public water systems not only **notify** their customers, but also **treat** the water to lower the fluoride concentration. Less than 1% of New Hampshire bedrock wells have fluoride that exceeds 4.0 mg/L of fluoride.

Specific health questions concerning fluoride's effects should be directed to a physician or dentist. For general health information concerning fluoride, please call the Environmental Health Risk Assessment Bureau of the New Hampshire Division of Public Health Services at 271-4608.

METHODS TO REDUCE FLUORIDE IN YOUR WATER SUPPLY

There are three approaches that one could take to respond to excess fluoride in a private well: use of town water, construct a new well, or install a water treatment device.

Town Water

In most cases this option is not available or is too costly. Town water however, is normally desirable when compared to a cellar full of water treatment devices.

New Wells

If the new well option is selected, a dug well or point well (both are located in sand and gravel deposits) would have the best chance for avoiding elevated fluoride. However, in many areas of New Hampshire the soil type, depth and year round sustained water table are not favorable for such wells. A new bedrock well would not likely be free of fluoride if your present bedrock well has an elevated fluoride level. The likelihood of avoiding fluoride in a new bedrock well can be estimated by having your neighbors test their wells for fluoride.

Treatment

There are at least three treatment options to remove fluoride as discussed below. Only that water used for drinking and water used for cooking needs to be treated when fluoride concentrations exceed 2.0-4.0 mg/L. A treatment system producing 2-5 gallons of water per day should be adequate. This size device installs easily "under-the-sink" and has a budget cost of approximately $750 (2001).

Reverse Osmosis

In this process, raw water flows past a reverse osmosis (RO) membrane. Some of the water molecules migrate through the membrane while others, the fluoride and other contaminants, remain on the raw water side of the membrane. This raw water concentrate is run disposed of to leach fields or a dry well. Treated water accumulates and is stored in a small pressure storage tank until needed. Some water

treatment suppliers also suggest installing a second treatment device in series for added treatment reliability. This device could be RO or a small amount of activated alumina as described below. If there are any solids in the water, a sediment pre-filter should precede the RO device. There is little maintenance required for RO units.

Distillation

Distillation, in either an under-the-sink or counter configuration, uses temperature change to evaporate and recondense water. Fluoride and other inorganic minerals will generally not transfer from the boiling chamber to the condensate chamber. Some organic contaminants can transfer across. Energy cost and reject heat are some common concerns. Maintenance requirements are minor; consisting only of periodic cleanout of solid minerals in the boiling chamber and possible wipe down of the condensate chamber.

Activated Alumina

Where much larger volumes of treated water are needed, the treatment process known as activated alumina becomes more cost effective. In this process the well water passes through a bed of activated alumina media. The fluoride "sticks" to the surface of the alumina by adsorption. Aluminum, from the adsorption media, is not given off. Alumina also removes arsenic very effectively. Although technically capable of fluoride removal, the economics of activated alumina treatment for fluoride may be poor. This approach would be used for whole house treatment.

Periodic Maintenance for Activated Alumina

Maintenance would consist of replacing the alumina media periodically. The old alumina may be disposed of along with your household trash. During startup, and subsequent operation, periodic laboratory testing is necessary to determine when breakthrough begins. The relationship between gallons treated and the alumina's treatment longevity is important in establishing a monitoring program. Once this relationship is known, sampling frequency over the long term can be reduced.

TESTING YOUR WATER

EAI Analytical Labs will provide you with your free water testing kit containing: sample bottles, detailed sampling instructions and a tracking form. Bacteria samples bottles are distributed pre-sterilized and all sample bottles contain their necessary preservatives. Kits are available for pickup or they can be mailed to you. If you are interested or have any questions regarding the analysis of your water, please give us a call.