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Virginia Household Water Quality Program: Sodium and Chloride in Household Drinking Water

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Private water sources, such as wells and springs, are not regulated by the U.S. Environmental Protection Agency (EPA). Although private well construction regulations exist in Virginia, private water supply owners are responsible for the maintenance of their water systems, for monitoring the quality of their drinking water, and for taking appropriate steps to address problems should they arise.

The EPA public drinking water standards are good guidelines for assessing your water quality. *Primary drinking water standards* apply to contaminants that can adversely affect health and are legally enforceable for public water systems. *Secondary drinking water standards* are non-regulatory guidelines for contaminants that may cause nuisance problems such as bad taste, foul odor, or staining.

Testing your water annually and routinely inspecting and maintaining your water supply system will help keep your water safe. For more information, visit the Virginia Household Water Quality Program website at www.wellwater.bse.vt.edu.

Introduction

Sodium and chloride, which together compose common table salt, often occur naturally in groundwater as it dissolves minerals underground. Higher levels of sodium and chloride in household water, however, often come from manmade sources such as road salt, industrial wastes, sewage, fertilizers, or water softeners. In coastal areas, sodium and chloride can also enter groundwater via salt water intrusion into fresh water aquifers. In high enough concentrations, salt water intrusion can render groundwater unsuitable for drinking, cooking, or irrigating.

Problems Associated With Sodium and Chloride

Sodium and chloride are not regulated as *primary* (health-related) contaminants in public water systems by the U.S. Environmental Protection Agency (EPA). Sodium is an essential mineral, and it is recommended that healthy adults consume at least 500 milligrams (mg) per day from water and food combined. The EPA has issued guidance that the concentration of sodium in drinking water not exceed 20 milligrams per liter (mg/L) for people who are on low sodium diets because of health-related issues. Excess sodium in the human diet may cause some people to have high blood pressure, which in turn may damage the heart and arteries or other organs. In 2009, EPA added sodium to the Contaminant Candidate List as a research priority, in an effort to reexamine existing guidance. According to the U.S. Department of Agriculture (USDA) and Department of Health and Human Services, the average estimated sodium intake for all Americans aged two years or older is 3,400 mg of sodium per day. The USDA (Dietary Reference Intakes) and the American Heart Association recommend adults consume no more than 1,500 mg of sodium per day, and therapeutic sodium-restricted diets can range from below 1,000 mg to 3,000 mg of sodium daily. In many cases, a significant amount of sodium in the diet originates from processed food and drinks or added table salt (Table 1).

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Table 1. Sodium content in common foods

Food	Weight (grams)	Sodium (mg) Low Sodium	Sodium (mg) Regular
Frankfurter (2), beef and pork, 10/pkg	100	–	1,008
Salmon (canned), drained	100	75	487
Tuna (canned), in oil, drained	100	50	354
English muffin	57	–	264
Bread (slice)	25	34	126
Crackers (low sodium vs. saltines)	30	198	390
Dry cereal*	30	2	275-350
Cooked cereal	100	1	200-285
Cheese, American processed	30	3	430
Cheese, cheddar	30	–	85
Cottage cheese	30	4	120
Whole milk (8 oz)	240	–	120
Hot chocolate (8 oz)	240	–	175
Peanut butter (1 tbs)	15	1	73
Pork and beans, canned	100	–	440
Diet soda* (12 oz)	360	–	20-70
Regular soda (12 oz)	360	–	14
Butter	5	1	41
Margarine	5	0-1	37-47
Mayonnaise and similar sandwich spreads	15	17	85-180

*Variation among brands may be considerable; check label.
Source: http://www.ksre.ksu.edu/library/H20QL2/MF1094.pdf

Although chloride in drinking water is generally not considered to be a health risk, the EPA has established a *secondary standard* (non-health related nuisance standard) of 250 mg/L for chloride. If the sodium or chloride concentrations in your drinking water are high, it is important to determine the source, because high levels of these elements in your water supply may indicate contamination from road salt, the inappropriate application of fertilizers, or from industrial waste or sewage. If contamination is suspected, testing for bacteria and other chemicals is advisable.

High levels of sodium or chloride in drinking water can cause water to have a salty taste. In addition, high levels of both of these constituents may accelerate corrosion of pipes, pumps, hot water heaters, and plumbing fixtures. To avoid these problems, the EPA recommends limiting sodium concentrations in drinking water to below 20 mg/L, and chloride concentrations to 250 mg/L or less.

Testing for Sodium and Chloride

Measurement of sodium and chloride in household water is most accurately made by a certified laboratory. When collecting any water sample, follow the instructions for proper sample collection carefully. A list of certified laboratories maintained by the Virginia Division of Consolidated Laboratory Services is available at: www.wellwater.bse.vt.edu/resources.php.

Treatment Options

Choosing the appropriate method to address sodium or chloride in a private water supply depends on the source and concentration of the contaminants.

Water softeners, often used to treat hard water (high concentrations of calcium and magnesium) can be a significant source of sodium in household water. With a few exceptions, most water softeners add sodium during the hardness removal process (about 1 mg/L of sodium added for every 2.1 mg/L of hardness removed). If maintaining low sodium levels is desirable, you can avoid adding sodium to drinking water by softening only the hot water (used for laundry, bathing, and cleaning) and leaving the cold water lines untreated for drinking and food preparation. You may also consider softening water with a system that uses potassium chloride, rather than sodium, as the ion-exchange mineral. Potassium chloride is generally more expensive and less available than sodium chloride. Be aware that excess potassium in drinking water can also present health risks to certain segments of the population, including individuals with kidney disease (most at risk) and other conditions like heart disease, coronary artery disease, hypertension, or diabetes. Individuals on certain medications may also need to be cautious. Consult a physician if you are con-

The Virginia Household Water Quality Program, offered through Virginia Cooperative Extension (VCE), periodically conducts county-based household water sampling clinics where you can learn about the quality of your water supply, proper water supply system maintenance, and, if needed, possible water treatment options. Please contact your local Extension office or visit www.wellwater.bse.vt.edu for more information.

cerned about the levels of sodium or potassium in your drinking water.

Sodium and chloride levels in wells may be reduced by limiting the application of road deicing salts in the vicinity of the well. Rerouting runoff from surfaces where deicing material is applied away from the well can prevent contamination.

Treatment methods to remove sodium and chloride from drinking water include reverse osmosis and distillation. Both of these treatment options treat a relatively small volume of water at any one time, can be costly, and typically require storage space for treated water. As a result, they are often considered point-of-use treatment options and may only be practical for installation at one faucet.

Reverse osmosis (RO) devices reduce many dissolved contaminants in water, including sodium and chloride. Water molecules are forced through a semi-permeable, cellophane-like membrane, which allows water to pass through, but retains most contaminants. Ten to twenty percent of the water entering the RO system exits as treated water, and the other 80 to 90 percent is wastewater, and is diverted to a drain. The wastewater contains 5-10 times the contaminant content of the initial feed. RO units can be wasteful unless equipped with an automatic shut-off valve. These systems work best with higher water pressure and often require pretreatment and post-treatment systems to work properly. They have an average lifetime of 3-5 years at which point the membrane must be replaced. These devices can be expensive to purchase and maintain.

Distillation devices involve boiling water and collecting the resulting steam and cooling it in a separate chamber. One of the benefits of distillation is that it uses no chemicals. Distillation, however, takes longer to produce the processed water than other methods, units can be expensive to operate, and the length of time distilled water is stored can affect its quality. In addition, distilled water has a very "flat" taste, because minerals naturally present in water are also removed during the process.

A complete water analysis for contaminants and/or the advice of a certified water treatment professional will help in selecting the specific treatment method appropriate for each application. Consumers should verify manufacturer claims before purchasing any water treatment device by contacting the National Sanitation Foundation (www.nsf.org) or the Water Quality Association (www.wqa.org).

If you are concerned about the health effects of sodium or chloride levels in your family's drinking water, consult your physician.

Additional Information

For more information on sodium and chloride in household water, see the following Virginia Cooperative Extension resources.

Virginia Household Water Quality Program website: www.wellwater.bse.vt.edu/resources.php.

Virginia Cooperative Extension website: http://pubs.ext.vt.edu/category/home-water-quality.html.

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