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Sodium and Chloride In Drinking Water[1]

The compound known as "salt" consists of the elements sodium and chloride. Many people use the word salt when they are actually referring to sodium. Every water supply contains some sodium and chloride. When salt dissolves in water it changes its form from a solid to an "ion." An atom or molecule that has dissolved in water is called an "ion". Salt readily dissolves in water. A chemist would use the following abbreviations when describing salt dissolved in water: sodium (Na+) and chloride (Cl-).

Occurrence of Sodium and Chloride

Typical background levels of Na+ and Cl- for pristine locations in New Hampshire are generally less than 15 milligrams per liter (mg/L) and 30 mg/L respectively. A milligram per liter is the same as saying a part per million parts (ppm). In the immediate seacoast area, elevated levels of Na+ and Cl- occur naturally due to the proximity to seawater. Seacoast area concentrations typically range up to 100 mg/L and 150 mg/L respectively.

Normally the chloride concentration of well water exceeds the sodium: often by approximately 50 percent. This is typically caused by the relative atomic weights of each, and the tendency of the soil to retard or chemically combine more with sodium than with chloride. Any judgment relative to a water's salt concentration should be made only after reviewing the results of a few samples that have been taken at different times of the year.

Substantially higher levels of Na+ and Cl- tend to imply contamination by activities of man including road salt storage, use of road salts, discharges from water softeners, human or animal waste disposal, leachate from landfills, and other activities.

Health Implications

The Bureau of Health Risk Assessment within the Department of Public Health Services has provided the following information, concerning health implications.

At present there are no health standards for Na+ or Cl- in drinking water. In the mid-1980s EPA had listed sodium in a group of contaminants, called the Drinking Water Priority List, for which official maximum contaminant levels (MCLs) would be developed. MCLs are health-based standards that must be met by public water systems. A subsequent review of scientific evidence by EPA showed that the vast amount of sodium ingestion was from food rather than drinking water, and that the linkage between sodium and hypertension (high blood pressure) was still not well documented. Consequently, in 1988, EPA removed sodium from that list of drinking water contaminants to be formally regulated by the Safe Drinking Water Act.

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).

On March 2, 1998 EPA reissued the list of contaminants for which MCLs may be developed. This list is now called the Drinking Water Contaminant Candidate List (DWCCL). This current list includes sodium.

Many brief EPA discussions concerning sodium in drinking water have appeared in the Federal Register over the last 15 years as noted below. The last three of these documents are included at the end of this fact sheet.

Wednesday, November 13, 1985, page 46980;
Wednesday, July 8, 1987, page 25723;
Friday, January 22, 1988, page 1894;
Monday, January 14, 1991, page 1471;
Monday, October 6, 1997, page 52211; and
Monday, March 2, 1998, page 10283.

When considering the health importance of Na+ and Cl-, EPA assumed that water users consume two liters of water per day and that 10 percent or less of a person's daily sodium intake comes from drinking water. The rest of an average person's sodium intake is usually from food. Persons on a sodium-restricted diet should evaluate all possible sources of sodium when attempting to reduce overall intake. It is often much easier and less expensive to make a dietary change than to excessively purify drinking water.

EPA has recommended that sodium levels not exceed 20 mg/L for those persons on a **physician-prescribed** "no salt diet". This is the same level recommended by the American Heart Association. This is a very stringent level. For comparison purposes, regular milk has a sodium concentration of approximately 500 mg/L. The sodium levels of certain other major foods are listed below.

Food Product	**Sodium Concentration**
Antacid	500 mg/L
Tomato sauce, cup	1,500 "
Ham, 3oz`	1,100 "
Bacon, 4 slices	550 "
Cottage cheese	450 "
White wine, 4oz	20 "
Club soda, 8 oz	40 "

Na+ and Cl - are generally not major contaminants in the water served by community public water systems in New Hampshire. Such systems typically have concentrations of Na+ and Cl- that are less than 75 mg/L each in almost all cases. Your local public water system is required to inform its customers annually of all water quality factors including Na+ and Cl-. There are no known health concerns with chloride.

Secondary (Aesthetic) Drinking Water Standards

Both Na+ and Cl- cause a taste in water. EPA has identified a concentration of over 250 mg/L of either Na+ & Cl- as a concentration that can impart a "salt" taste to drinking water. Typically chloride has the stronger taste response. This level is based on aesthetic concerns and is only advisory in the EPA Safe Drinking Water Act program.

Control of Sodium and Chloride

Normally the best method to control Na+ and Cl- in drinking water is to better manage those activities that add salt near the recharge area of the water supply source(s). The following are the most common sources of salt in water supplies.

Application of road deicing salts. Road salt runoff can contaminant groundwater. Limiting the application of salt in the vicinity of a well, rerouting runoff, and installing clay-lined drainage swales along the roadside may all reduce the Na+ and Cl- concentrations in adjacent wells. If de-icing salts contaminate a well and the origin is suspected to be from a state highway, the New Hampshire Department of Transportation, Bureau of Highway Maintenance, may help correct the situation. Please call them at 603-271-2693 for more information.

Water softeners add sodium to drinking water in two ways. Directly during the hardness removal process, and indirectly by the discharge of waste brine (salt dissolved in water) into subsurface disposal systems. The amount of salt added by a water softener can be substantial if a water's hardness is high. Using water meters can reduce the volume of waste brine generated in the regeneration cycle or ion probes to trigger regeneration. This is called demand regeneration.

Other Sources. Many water treatment chemicals have sodium as a basic ingredient. These chemicals often perform a valued treatment function. However, they do raise the sodium level in water proportional to the amount applied. Near the coast, some sodium and chloride may be due to seawater from either storm spray or underground intrusion.

Sanitary Significance of Sodium and Chloride

Na+ and Cl- are also present in human wastewater. Finding the source of elevated Na+ and Cl- is important since Na+ and Cl- may indicate the nearby disposal of human wastewater or solid fecal waste. The presence of elevated Na+ and Cl- must initially be considered as an indication of increased risk of more serious bacterial or chemical pollution until a more detailed analysis identifies the origin of the Na+/ Cl-.

Treatment to Remove Sodium or Chloride

Sodium and chloride are costly to remove from water. Effective treatment types include:

Treatment Type	Drawbacks
Reverse osmosis	May not be practical for high volume need due to the cold water "reject" rate
Distillation	Very costly to operate
De-ionization (Ion exchange)	Practical

Where treatment is going to be installed, the size of the device can range from an under-the-sink system to full house treatment. If only pure drinking water is the goal, then an under-the-sink system will suffice.

The presence of elevated levels of sodium and chloride somewhat increases the water's ionic conductance and thus increases the potential for corrosive damage to plumbing fixtures. To reduce this damage totally, the treatment system would need to be installed to service the entire home. Bottled water is also an option to address the health concerns (posed by leached lead and copper caused by corrosive water) in the interim period, while a long-term solution is being investigated.

Vegetation Damage

Highway de-icing salt application can impact vegetation. Windblown salt spray can be as much a concern as salt laden water runoff. In general, damage lessens with greater distance from the road, lower salt application rates and the species of tree. Salt tolerant species include Norway maples, horse chestnut, white ash, Colorado spruce, white popular, and golden weeping willow to name some. For more details concerning vegetation damage please call the University of New Hampshire Cooperative Extension at 862-3200.

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.