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Environmental Fact Sheet

(Information compiled from New Hampshire Department of Environmental Services Literature)

Hardness in Drinking Water

DEFINITION OF HARDNESS

Hardness in drinking water is defined as those minerals that dissolve in water having a positive electrical charge. The primary components of hardness are calcium (Ca^{++}) and magnesium (Mg^{++}) ions. Dissolved iron (Fe^{++}) and manganese (Mn^{++}) also satisfy the definition of hardness, but typically make up only a very small fraction of total hardness. Minerals are composed of either atoms or molecules. An atom or molecule that has dissolved in water is called an "ion." Positively charged ions are called cations and are noted as (+). A double sign would indicate a plus two electrical charge. Contaminants having a similar positive charge would be removed by a matching type of ion exchange resin, i.e. water softening.

HEALTH/AESTHETIC EFFECTS OF HARDNESS

The presence or absence of the hardness minerals in drinking water is not known to pose a health risk to users. Hardness is normally considered an aesthetic water quality factor. The presence of some dissolved mineral material in drinking water is typically what gives the water its characteristic and pleasant taste. At higher concentrations however, hardness creates the following consumer problems.

- Produces soap scum most noticeable on tubs and showers.
- Produces white mineral deposits on dishes more noticeable on clear glassware.
- Reduces the efficiency of devices that heat water. As hardness deposits build in thickness, they act like insulation, reducing the efficiency of heat transfer. It has also been observed that areas of higher hardness in drinking water maybe associated with lower incidents of heart disease. This possible relationship is being investigated.

EXPRESSING THE AMOUNT OF HARDNESS IN WATER

There are two numbering systems used by drinking water professionals to identify the concentration of hardness in drinking water.

They are:

- Milligrams per liter, abbreviated as mg/L; can also be defined as parts per million, abbreviated as ppm.
- Grains per gallon, abbreviated as gpg.

To convert from one hardness scale to the other, use the following formulas:

a. (the concentration in milligrams per liter) x $1/17.2$ = (the concentration in grains per gallon)
b. (the concentration in grains per gallon) x 17.2 = (the concentration in milligrams per liter)

Equivalent Concentration as $CaCO_3$

The concentration of hardness in water is normally **reported** as an equivalent concentration of calcium carbonate ($CaCO_3$). This laboratory calculation provides a common reference to identify the chemical **reactive power** of various compounds regardless of their atomic weight or valance. Thus using the typical laboratory units used for expressing hardness are "mg/L as calcium carbonate." The equivalent weights for various cations are shown below.

Contaminate Concentration Equivalent Weight

10 mg/L Calcium 24.97 mg/L as $CaC0_3$
10 mg/L Magnesium 41.18 mg/L as $CaC0_3$

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CATEGORIZING HARDNESS

Shown below are the two common severity scales used to categorize hardness.

Categorizing Hardness
(mg/L as $CaCO_3$)
soft water 0-75 0-50
somewhat hard water 76 to 150 51-100
hard water 151 to 300 101-150
very hard water 301 and up 151 and up

FOR MORE INFORMATION

Water softeners are typically used to treat hard water. Please contact Nelson Analytical Lab regarding testing your drinking water for hardness. We can mail you a water test kit with the necessary test bottle and water sampling instructions. Results will be emailed upon completion within 1 to 2 business days. Nelson Analytical Lab will discuss your test results with you should you have any questions or concerns, or would like to be directed to speak with a water treatment company regarding treatment options for your water supply.