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Health Lifestyles, Healthy Communities

Understanding Your Water Test Report: Microbiological, Chemical and Nuisance Contaminants

This document summarizes information to assist you in deciding what to test for in your water and to help you interpret the laboratory results. It is primarily for homeowners with individual water supplies (wells).

Regular water tests are recommended for all household water systems. Public water supplies are tested regularly in accordance with state and federal regulation. Also, the Snohomish Health District (SHD) has established primary drinking water standards as applied to SHD response to requests for assessments on individual water systems. These water quality parameters, which SHD views as fundamental towards determining the potability (safe to drink) of water supplies, are noted as "**SHD required test"**. Owners and users of individual water supplies are advised to test their water regularly.

Drinking Water Standards

Drinking water standards are established for contaminants which may have adverse effects on people's health and for contaminants which have aesthetic effects such as taste, odor or staining. Standards for contaminants which could impact health are called primary drinking water standards.

Understanding the Safe Drinking Water Standard

MCL: The MCL is the maximum contaminant level allowed in a water system and represents the basis for SHD assessments of individual water supplies. Drinking water standards are subject to change. The following discussion includes current standards and although the MCLs may change, the discussion of potential health effects is unlikely to be significantly changed.

SMCL: Standards for aesthetic contaminants are called secondary maximum contaminant levels (SMCL). Water containing these contaminants at levels in excess of SMCLs may have unpleasant taste, odor, and/or appearance.

Microbiological Contaminants

Microbiological contaminants include the living organisms in water which are capable of reproducing or growing either in water or in the host, once ingested. These contaminants include bacteria, protozoa (may be in cyst form), viruses and parasitic worms. Microbiological contaminants have been responsible for the majority of illness and disease associated with polluted water in the past. Filtration and disinfection are the primary methods for control of microbiological contaminants.

Bacteria, coliform *(SHD required test)* (MCL: 0 present utilizing the "Presence/Absence" Methods)
The test for coliform bacteria has been the standard test for microbiological safety for several decades. It is an excellent indicator of contamination in water supplies. The test evaluates for coliform bacteria which are widely distributed throughout the environment in soil, on plants, on animals and in very large numbers in the feces of warm-blooded animals. When coliform bacteria are present, it means water has been exposed to one or more of these sources.

For "Presence/Absence" type tests, results are generally reported as satisfactory (absent) or unsatisfactory (present). In cases of unsatisfactory results, the lab will often report the presence/absence of "Fecal coliform" and/or "E. coli" (not the same E. coli associated with the food-borne outbreak from hamburgers). Although this may be of some value in determining the potential for the contamination originating from human and/or other warm-blooded animals, the consequence is still the same - the water supply should not be consumed. Coliform bacteria in a water supply mean the water has been affected by the environment and disease-causing organisms may be present. Therefore, the presence of any coliform is cause for concern and corrective action must be taken.

Steps to ensure safe water and protect against bacteria problems include:

1. Ensure safety of the water source. (Is the well located away from possible contamination sources? Is it constructed properly with an adequate surface (ecology) seal? Is it well maintained with a secure lid?)
2. Verify integrity of the distribution system. (Is it free of cross connections? Do outlets have adequate air gaps and/or backflow preventers? Are there any leaks?)
3. Periodic maintenance and water quality monitoring.

Bacteria, other than coliform (no standard)

Although no direct standard exists for bacteria other than coliform, the presence of these in large numbers generally means the water is of poor quality. Consequently, routine testing for bacteria other than coliform is generally not conducted. For information on testing for bacteria other than coliform, please contact the lab. Presence of any bacteria suggests that the water supply or the water system is or has been open to the environment.

Inorganic Chemical Contaminants

Inorganic chemicals regulated by drinking water standards are widespread in the environment. Concentrations of inorganic chemicals which exceed the MCLs may be due to human activities or natural conditions or both. Levels of most inorganic chemicals are greatly influenced by types of soil, rock, and minerals present.

Aluminum (proposed SMCL: 0.05 mg/L)

Aluminum is widespread in the environment. Intake occurs through food, water and air. Aluminum has been suspected of contributing to Alzheimer's disease but inadequate scientific data exists to substantiate a cause-effect relationship.

Arsenic (MCL: 0.010 mg/L) *(SHD required test)*

Arsenic is a mineral commonly found in the environment. Arsenic is naturally occurring and can be found in soils, bedrock and groundwater. Studies show that concentrations of arsenic in groundwater can change over time.

When it occurs in groundwater wells, arsenic can pose a public health concern. Some people who drink water containing arsenic in excess of the MCL over many years could experience skin damage or problems with their circulatory system and may have an increased risk of cancer. Arsenic is naturally occurring in the Snohomish County region and measured levels vary over time.

Asbestos (Proposed MCL: 7 million fibers/liter over 10 microns long)

Asbestos occurs naturally in the environment and has been used in asbestos-cement pipes in water distribution systems and in well casings.

Barium (MCL: 2.0 mg/L) ***(SHD required test)***
Barium is fatal to humans in high doses (over 500 mg). No study appears to have been made of the amounts of barium that can be tolerated in drinking water, but because of its toxic effects on the heart, blood vessels and nerves, a level with a large safety factor has been set. Barium can accumulate in the liver, lungs and spleen. It can cause nervous system disorders, heart disease and circulation impairment.

Cadmium (MCL: 0.005 mg/L) ***(SHD required test)***
As far as is known, cadmium is biologically a nonessential, non-beneficial element of high toxic potential. The health effects of long-term exposure in the U.S. appear to be from diet, cigarette smoking and seepage into the groundwater from industrial plants. Cadmium is believed to be mutagenic but not carcinogenic.

Chloride (SMCL: 250 mg/L)
The SMCL of 250 mg/L for chloride is the level above which the taste of the water may become objectionable. In addition to adverse taste, high chloride concentrations in the water contribute to the deterioration of domestic plumbing and water heaters. Chloride is suspected of being a contributor to hypertension (high blood pressure). High chloride concentrations may also be associated with the presence of sodium in drinking water. See sodium discussion.

Chromium (MCL: 0.10 mg/L) ***(SHD required test)***
Chromium is toxic to humans. Long-term exposure may cause skin and nasal ulcers. Chromium accumulates in the spleen, bones, kidney and liver. It occurs in some foods, in air (including cigarette smoke) and in some water supplies. Chromium is involved in use of blood sugar and is considered an essential nutrient.

Copper (SMCL: 1.3 mg/L)
Copper in drinking water generally originates from copper piping and/or fixtures and is normally not a concern, as the levels required to produce health effects in most people exceed the maximum possible concentrations. Experience indicates that copper at concentration levels exceeding 2 mg/L causes blue-green staining of plumbing fixtures and a noticeable taste. In instances where high copper concentration levels in the drinking water are observed, it is likely that other heavy metals are also present. Water containing 4 mg/L copper may impart a green tint to dyed hair.

Fluoride (MCL: 4 mg/L, SMCL: 2 mg/L) ***(SHD required test)***
Fluoride in drinking water can occur naturally or may be added in some public systems. A fluoride concentration of approximately 1 mg/L helps prevent dental cavities and osteoporosis. At concentrations below 0.7 mg/L, fluoride would likely not be of benefit. At concentrations above 2 mg/L, fluoride may cause staining of enamel of permanent teeth. This is most commonly a problem for children up to about 10 years old. There is no conclusive evidence that fluoride or fluoridation causes cancer in humans.

Iron (SMCL: 0.30 mg/L)
Iron occurs naturally in many groundwater supplies throughout Snohomish County. It is essential in human and animal diets, but levels above the SMCL may impart an objectionable taste or odor to water and cause red staining of porcelain fixtures and laundry.

Frequently, water with dissolved iron shows evidence of iron bacteria. These organisms use the iron as a source of energy and accumulate masses that may plug well screens, pumps and pipelines. In time, a rust colored, jelly-like mass may break loose and enter the plumbing system. Iron bacteria will coat nearly everything, including toilet tanks, pipes and storage tanks. Decaying dead iron bacteria impart a bad taste to the water and leave stains that are very difficult to remove.

Lead (Environmental Protection Agency Action Level: 0.015 mg/L) ***(SHD required test)***
As applied to individual drinking water supplies, the EPA action level of 0.015 mg/L is considered synonymous with an MCL.

Lead exposure occurs from air, food and water sources. Exposure to lead in water can seriously injure health. All exposure is additive. Lead accumulates in the bones, resulting in elevated levels in blood. Known effects range from subtle biochemical changes at low levels of exposure to severe neurological and toxic effects and even death at much higher levels.

As with several other water contaminants, children, infants and fetuses are especially vulnerable to lead. Infants and children absorb a much greater portion of lead intake than adults and their immature, developing bodies and central nervous systems are much more sensitive to its effects. A child's mental and physical development can be irreversibly stunted by over-exposure to lead. Health effects include reduced mental capacity, interference with kidney and neurological functions and hearing loss in children.

Lead may occur naturally in rocks and soil, leach from contaminated soils, or leach from plumbing materials and fixtures.

Manganese (SMCL: 0.05 mg/L)
Excess manganese may produce a black or gray color in laundered goods and may impair the taste of tea, coffee and other beverages. Concentrations above the standard may also cause a dark stain on porcelain plumbing fixtures. As with iron, manganese may form a coating on distribution pipes which may slough too, causing dark stains on laundered clothing or black particles in the water.

Mercury (MCL: 0.002 mg/L) ***(SHD required test)***
Mercury is distributed throughout the environment as a result of industrial and agricultural applications. Outside of occupational exposure, food (particularly fish) is typically the greatest contributor to total mercury intake. Poisoning is characterized by major changes in the brain, including loss of vision and hearing, intellectual deterioration, and even death.

Nitrate (MCL: 10 mg/L) ***(SHD required test)***
Nitrate can occur in water through natural sources as well as human activities. Nitrate has caused methemoglobinemia (infant cyanosis) or blue baby disease in infants less than 6 months old who have been given water or formula mixed with water high in nitrate.

The nitrate standard is established to protect infants less than a year old who consume water in formula or directly. There is little or no margin of safety for some infants. In rare cases, illness and even death have occurred with concentrations just above this level after only a day or two of exposure. Pregnant women should also avoid water above this standard.

Selenium (MCL: 0.05 mg/L) ***(SHD required test)***
There is considerable difficulty in determining the toxic levels of selenium intake in humans because the diet contains an unknown variety of selenium compounds in varying mixtures. Possible health effects include growth inhibition; skin discoloration; dental and digestive problems; liver damage; and psychological disorders.

Silver (MCL: 0.05 mg/L) ***(SHD required test)***
The chief effect of silver on humans is a condition called argyria or argyrosis, and unsightly, permanent blue-gray discoloration of the skin, eyes and mucous membranes. Because silver, once absorbed, is held indefinitely in the body tissues, a maximum level has been set.

Sodium (no standard established) ***(SHD required test)***
Sodium is present in almost all groundwater. The amount varies widely, from less than 10 to several hundred mg/L. Home water softeners (cation exchange type, using sodium chloride [salt] for recharge) add significantly to sodium in the water because they exchange sodium for the hardness minerals. Because of the increase in sodium and reduction in calcium and magnesium, unsoftened water is recommended for drinking purposes. Evidence suggests that prolonged excessive sodium intake (over 3,300 mg/day) increases the risk of hypertension for some individuals. For most persons the sodium content of water is unimportant because the body eliminates the excess. The amount of sodium in the water may be important for those on a low-sodium diet. The usual low-sodium diets allow only about 20 mg/L sodium in drinking water.

Sulfate (SMCL: 250 mg/L)
Sulfate has no known health effects at concentrations up to about twice the standard so it has a secondary standard. High concentrations of sulfate in drinking water have three effects: (1) may form hard scales in boilers and heat exchangers; (2) can produce taste; and (3) may have a laxative effect for those not use to it. Also, sulfate may be utilized as a source of energy for some bacteria resulting in production of hydrogen sulfide gas resulting in a "rotten egg" smell from the water. (See hydrogen sulfide discussion below.)

Zinc (SMCL: 5 mg/L)
Zinc is found in some natural waters. It is not considered detrimental to health unless in occurs in very high concentrations. However, it does give an undesirable taste and appearance to drinking water.

Other Water Quality Parameters

This category includes hardness, hydrogen sulfide and pH which are sometimes considered nuisance contaminants. Standards generally do not exist. Unlike coliform bacteria and many of the inorganic chemicals that cannot be detected by the senses, these contaminants are usually recognized directly or indirectly through the observed effects.

Hardness (No standard established)
Water readily dissolves calcium and magnesium from the soil and rocks. In addition to calcium and magnesium, iron and manganese also contribute to hardness. Hardness minerals react with soaps and detergents producing scums and deposits which make unsightly rings in the bath tub and wash basin and leave deposits on clothes. Hardness minerals give water flavor and have no known health effect. Laboratory results may be reported in either mg/L (ppm) or in grains. The following tables may help interpret water hardness. To convert grains per gallon to parts per million multiply hardness (gpg) by 17.1.

mg/L	Grains per gallon	Description
0-60	0-3.5	Soft – no hardness problems
60-120	3.5-7	Moderately hard – some hardness problems
120-180		Hard – definite hardness problems. Selection of detergents helps.
180-350	10.5-20.5	Very hard
Over 350	Over 20.5	Extremely hard

Hydrogen Sulfide
Hydrogen sulfide, a gas, is called the "rotten egg" gas because of its odor. It is one of a few water contaminants that can be detected at low concentration by the sense of smell. In fact, our ability to smell this gas as it is released to the atmosphere is more sensitive than equipment to measure it and the gas readily dissipates when the water is exposed to air. Consequently, testing directly for hydrogen sulfide is generally not practical.

Bacteria which use sulfate as an energy source are the primary way that large quantities of hydrogen sulfide are generated. Also, hydrogen sulfide may be produced during the decay of iron bacteria. (See sulfate discussion above.)

pH
The term "pH" indicates whether water is acidic or basic. The scale is 0 to 14 with 7.0 being neutral. Acids are less than 7 with bases greater than 7. Low pH may be responsible for "leaching" certain metals into the water, particularly lead and copper.