**DEPARTMENT OF PUBLIC HEALTH AND HUMAN SERVICES**
**STATE OF MONTANA**
**ENVIRONMENTAL LABORATORY**
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# EXPLANATION OF TESTS

All sources of drinking water are subject to potential contamination by constituents that are naturally occurring or are man made. Those constituents can be microbes, organic or inorganic chemicals, or radioactive materials. All drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that the water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the **Environmental Protection Agency's Safe Drinking Water Hotline at 1-800-426-4791**, or by contacting your local County Health Department, County Sanitarian, County Extension Agent or the DPHHS Environmental Laboratory. Please call the DPHHS Environmental Laboratory at (406) 444-3444 for questions about your results or for additional testing.

Most results are reported in milligrams per liter (mg/L), which is equivalent to parts per million (parts of material per million parts of water). Parts per million may be converted to grains per gallon by dividing by 17.1.

**Alkalinity** - The alkalinity of water is a measure of its capacity to neutralize acids and is due primarily to the presence of carbonates and bicarbonates. The acceptable alkalinity for municipal water supplies is generally between 30 and 500 mg/L as CaCO3, but there are many water supplies above and below these limitations. Waters with alkalinity greater than 500 mg/L as CaCO3 may have objectionable tastes.

**Arsenic** – Arsenic occurs naturally in rock and soil. Arsenic in water is frequently found near mining areas and hot springs. Normal weathering or exposure to acid mine drainage can cause arsenic to be deposited in water. Arsenic is also used in manufacturing, refineries, wood preservatives, animal feed additives and herbicides. Some people who drink water containing arsenic in excess of the recommended limit over many years could experience skin damage or problems with their circulatory system, and may have an increased risk of getting cancer. The EPA has set a limit of 0.010 mg/L in public water supplies.

**Calcium** – Calcium in water is the major cause of calcium water hardness and is usually in the range of 5-500 mg/L, as CaCO3. Calcium is also the fifth most abundant dissolved ion in water. It is essential for living organisms, particularly in cell physiology. As a major material used in mineralization of bones and shells, calcium is the most abundant metal by mass in many animals. Calcium in water, as with all water hardness, can be removed with a simple sodium form cation exchanger (water softener). Reverse Osmosis Water System will remove 95-98% of the calcium in the water.

**Chloride** - Chloride salts in excess of 100 mg/L may give a salty taste to water. Chloride may increase the corrosive activity of water when combined with calcium and magnesium. EPA recommends that the chloride content should not exceed 250 mg/L.

**Copper** - Copper is a metal found in natural ore deposits. It is an essential nutrient, required by the body in very small amounts. It is widely used in household plumbing materials. Corrosion of household plumbing systems, erosion of natural deposits, and leaching from wood preservatives are ways copper may enter drinking water. The EPA has found that copper may cause stomach and intestinal distress in sensitive individuals when they are exposed to levels above the Action Level* (1.3 mg/L) for relatively short periods of time. Some who drink water containing copper in excess of the action level over many years could suffer liver or kidney damage. People with Wilson's Disease should consult their personal doctor. It is always a good idea to let a faucet run for a minute or two before drawing water for drinking or cooking. EPA's action level for copper is 1.3 mg/L.

**E. Coli** is a coliform bacterium of fecal origin whose presence indicates that the water may be contaminated with human or animal wastes. These wastes may come from septic systems, sewage plants, feedlots and pastures, or from wildlife, domesticated animals and pets. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, and people with severely compromised immune systems.

**Fluoride** – Fluoride is found in combined form in numerous rock types in nature. Fluoride may enter drinking water through erosion of natural deposits, as a water additive which promotes strong teeth, and through discharge from fertilizer and aluminum factories. A fluoride concentration between 0.7 to 1.5 mg/L is effective in the prevention of dental caries. Fluoride concentrations greater than 2.0 mg/L may produce fluorosis (mottling of the teeth) in children under the age of nine. Drinking levels of fluoride in excess of the EPA's drinking water limit may lead to fluorosis and bone damage, including pain and tenderness of the bones. EPA has set a drinking water limit for fluoride at 4 mg/L.

**Hardness** - In most water nearly all of the hardness is due to calcium and magnesium. Calcium and magnesium, which are naturally occurring in rock and soil, react with soap to form precipitates which increase soap consumption, and react with certain constituents to form scale. As a general rule, a value of below 60 mg/L is considered soft; from 60 to 120 mg/L is considered moderately hard; from 120 to 180 mg/L is considered hard; and values above 180 mg/L are considered very hard.

**Iron** - More than about 0.3 mg/L of iron may stains laundry and utensils reddish brown. Larger quantities cause unpleasant taste and odor, and may encourage growth of iron bacteria, which may produce a "rotten egg" or sulfur odor. Excessive iron may also interfere with the efficient operation of exchange-silicate water softeners. EPA recommends iron levels in water be below 0.3 mg/L, for aesthetic purposes.

**Lead** – Lead is a naturally occurring element that is found is small amounts in the earth's crust. Most contamination from lead is caused by human activities. Lead may be released into the environment through discharges from factories or smelters, or leaching by acid mine drainage. Drinking water may leach lead from soldered joints or old lead pipes. Infants and young children are typically more vulnerable to lead in drinking water than the general population. Lead in drinking water is rarely the sole cause of lead poisoning, but it can add to a person's total lead exposure. Infants and children who drink water containing lead in excess of the Action Level* could experience delays in their physical or mental development. Children could show slight deficits in attention span and learning abilities. Adults who drink this water over many years could develop kidney problems or high blood pressure. It is always a good idea to let a faucet run for a minute or two before drawing water for drinking or cooking. The EPA has set an action level of 0.015 mg/L lead in public water supplies.

**Magnesium** – Magnesium is the 11$^{th}$ most abundant element by mass in the human body; its ions are essential to all living cells. Magnesium salts are frequently included in various foods, fertilizers and culture media. It is present in seawater in amounts of about 1300 ppm. Drinking water usually contains between 1 and 5 mg of magnesium per liter. Magnesium and other alkali earth metals, such as calcium, are responsible for water hardness.

**Manganese** – Manganese is a naturally occurring substance found in rocks, soil, and food. It is an essential nutrient usually supplied by foods. Manganese is often found in drinking water, where it may be considered an undesirable impurity in high levels due to its tendency to form black oxide stains. The EPA has not set a specific drinking water limit, but the recommended limit is 0.5 mg/L to prevent staining of clothes or plumbing fixtures.

**Nitrate** (Nitrate + Nitrite) - Nitrate is present naturally in the environment. It is a constituent of plant material, where it is found in varying levels dependent on the type of plant. Foods such as lettuce, celery, beets and spinach may contain elevated levels of nitrate, but when nitrate-containing foods are eaten as part of a balanced diet, nitrate exposure is not thought to be harmful. Elevated levels of nitrate in drinking water (above 10 milligrams per liter) may cause a condition called methemoglobinemia, or "blue baby syndrome", in infants under 6 months of age. Nitrate is converted to nitrite in the digestive system of infants; nitrite then interferes with the oxygen-carrying ability of the blood, causing lack of oxygen to the brain and other organs. Infants suffering from "blue baby syndrome" need immediate medical care. Adults are normally not affected by nitrate at this level. Nitrate contamination may come from erosion of natural deposits, from dead and decaying plant material, runoff from fertilizer use, leaching from septic tanks or sewage systems and from runoff of animal wastes from feedlots, corrals and barns. EPA has set a limit for nitrate in public drinking water systems at 10 mg/L.

**pH** - The pH of a sample is an indication of how acidic or basic the water is. On a scale of 1 to 14, with 1 being highly acidic and 14 being highly basic, lemon juice may have a pH of around 2, while household bleach may have a pH of 12.5. A pH of 7 units is considered neutral. Highly acidic water may promote the leaching of metals from plumbing pipes. The US EPA recommends drinking water have a pH between 6.5 to 8.5 units.

**Sodium** – Sodium is a naturally occurring element usually found in the environment that combines with other compounds (such as chloride or bicarbonate) to form salts. Sodium is an essential nutrient in human physiology, and is normally supplied by food. Sodium content may be of interest to persons on sodium restricted diets. Sodium restricted diets are essential in treating congestive cardiac failure, hypertension, renal disease, cirrhosis of the liver, toxemias of pregnancy, and Meniere's disease. If you feel this may be applicable to you or members of your household, it is recommended that your physicians be informed of the sodium content. EPA has set no drinking water limit for sodium.

**Specific Conductance** - Specific Conductivity, measured in micro mhos per centimeter (umho/cm), is a measure of the ability of water to conduct an electrical current; it is also referred to as the salinity, salt content, the total mineral content or "alkali" content. It is dependent on the amount of dissolved minerals (such as salt) in the water. Generally, the more dissolved material in the water, the more electrical current that can be transmitted. A large amount of dissolved material in water may adversely affect its quality. Distilled water has a very low conductivity of around 2 umho, while sea water or saline seep water has a high conductivity of 10,000-20,000 umho/cm. Some typical dissolved materials are sodium, magnesium, calcium, iron, chloride, nitrate, sulfate and phosphate. Dissolved minerals may come from rocks and soil as water runs through and across it. Due to the many different constituents that make up the total mineral content, it is difficult to set a standard for human consumption. Drinking waters up to 400 umhos/cm are considered excellent, while water with conductivity above 8500 umhos/cm may have an objectionable taste. Conductivity may be converted to Total Dissolved Solids (TDS) by the following formula: TDS = (SPC) * (0.55 to 0.7)

**Sulfate** - Sulfate is a substance that occurs naturally in drinking water. Sulfate in water containing calcium forms hard scale in steam boilers. High concentrations of sulfate in combination with other constituents give a bitter taste to water. Concentrations above 250 mg/L may have a laxative effect for those not used to drinking the water, but 500 mg/L is considered safe for human consumption. Domestic water in Montana containing as much as 1,000 mg/L sulfate is used for drinking in the absence of a less mineralized water supply. EPA recommends sulfate be below 250 mg/L, based on aesthetic effects (i.e., taste and odor).

**Total Coliform Bacteria** - **Total Coliforms** are a large group of usually harmless bacteria that are naturally present in soil and vegetation, and also in the intestinal tract of warm-blooded animals. Although total coliforms normally do not produce illness, their presence in drinking water is used as an indicator that other, potentially harmful bacteria from the intestinal tract of animals may be present. Since total coliforms and fecal coliforms often coexist, the presence of total coliform in drinking water is a warning to check for possible sources of contamination.

**Uranium** – Uranium is a naturally-occurring radioactive element. Uranium is commonly found in very small amounts in rocks, soil, water, plants, and animals (including humans). Uranium is weakly radioactive and contributes to low levels of natural background radiation in the environment. EPA has set a limit of 0.03 mg/l. More information can be found at http://www.epa.gov/rpdweb00/radionuclides/uranium.html

**Zinc -** Zinc is one of the most common elements in the earth's crust. It is found in air, soil, and water, and is present in foods. It has many commercial uses as coatings to prevent rust, in dry cell batteries, and mixed with other metals to make alloys like brass and bronze. A zinc and copper alloy is used to make pennies in the United States. Zinc combines with other elements to form zinc compounds which are widely used in industry to make paint, rubber, dye, wood preservatives, and ointments. EPA does not regulate zinc in drinking water, but recommends that there be no more than 5 parts per million (5 ppm) of zinc drinking water because of taste.

*Action Level - the concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a Public Drinking Water Supply system must follow. Private wells are not affected by this regulation.