Explanation Of Water Analysis

1. **Alkalinity**
   Alkalinity is water's acidneutralizing capacity and is primarily a function of carbonate, bicarbonate and hydroxide content. Excessive alkalinity levels may cause scale formation. The aesthetic objective is set at a maximum of 500 mg/L.
2. **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 exist to substantiate a cause-effect relationship.
3. **Arsenic**
   Arsenic is a metalloid with four oxidation states. It is widely distributed throughout the earth's crust and is present in trace amounts in all-living matter. Arsenicals are used commercially and industrially for example, as alloying agents, in the processing of glass and pigment, in the hide tanning process and as pesticides, feed additives and pharmaceuticals. Symptoms of acute arsenic intoxication associated with the ingestion of well water contaminated with arsenic include abdominal pain, vomiting and pain to the extremities and muscles. The IMAC for arsenic in drinking water is 0.025 mg/L.
4. **Asbestos (Proposed MCL and MCLG: 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. It has been introduced into drinking water through the corrosion of asbestos-reinforced cement pipes by water with a low pH. Water that has high pH and low corrosivity should prevent the deterioration of pipes that would introduce asbestos into water.
5. **Barium (MCL: 1.0 mg/L)**
   Barium is fatal to humans in high doses (more than 550 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.
6. **Bicarbonate (HCO3)**
   Bicarbonate is the major form of alkalinity. In excessive amounts, bicarbonates, in conjunction with calcium, may cause scale formation in heated waters. See Total Alkalinity.
7. **Cadmium (MCL: 0.01 mg/L)**
   As far as is known, cadmium is biologically a nonessential, nonbeneficial element of high toxic potential. Evidence for the serious toxic potential of cadmium is provided by; a) poisoning form cadmium-contaminated food and beverages; b) epidemiological evidence that cadmium may be associated with renal arterial hypertension under certain conditions; c) epidemiological association of cadmium with Itaiitai disease in Japan: d) long-term oral toxicity studies in animals. The health effects of long-term exposure in the U.S. appear to be for diet, cigarette smoking and sege into the groundwater from industrial plants especially wastewater. Cadmium is believed to be mutagenic but not carcinogenic.
8. **Calcium (Ca)**
   The present of calcium in water supplies results from passage through or over limestone, dolomite and other calcium containing deposits. Small concentrations of calcium carbonate combat corrosion of metal pipes by laying down a protective coating. Higher levels of calcium salts can precipitate when heated to form scale in boilers, pipes and

cooking utensils. Calcium contributes to the total hardness of water. There is no aesthetic objective or maximum acceptable concentration set for calcium. See Total Hardness.

9. **Carbonate (CO3)**
   Carbonates can only exist if the pH of the water exceeds 8.3. This seldom occurs in natural waters. No aesthetic objective or maximum acceptable concentration has been set for carbonates alone. See Total Alkalinity.
10. **Chlorides (CI)**
    Concentrations of chloride in excess of 250 mg/L may impart a salty taste to the water. Therefore, the aesthetic objective is set at a maximum of 250 mg/L. However the salty taste is variable and dependant on the chemical composition of the water. No evidence has been found to indicate that ingestion of chloride is harmful to humans. A high chloride content may harm metallic pipes and structures as well as growing plants.
11. **Chromium Total (MCL: 0.05 mg/L)**
    Chromium is toxic to humans, produces lung tumors when inhaled and causes skin irritations. 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. The level of chromium that can be tolerated over a lifetime without adverse affects is still undetermined. Chromium is involved in use of blood sugar and is considered an essential nutrient.
12. **Coliform Bacteria**
    The presence of coliform organisms is an indication of pollution. The maximum acceptable concentration for total coliforms is no organisms detectable per 100 mL of sample. If any coliform organisms are detected, the site should be resampled, and if the presence of coliforms is confirmed, the appropriate corrective action should be taken. The test for coliform bacteria has been the standard test for microbiological safety for several decades. It is an excellent indicator of possible contamination in disinfected public water supplies. The test evaluates for coliform bacteria, which are widely distributed in the environment in soil, on plants, on animals and in very large numbers in the feces of mammals. When coliform are present, it means water has been exposed to one or more of these sources. In disinfected systems, this means the water has been recontaminated or disinfection is inadequate and the water may contain pathogens (disease-causing organisms). Illness caused by pathogens commonly transmitted by water includes typhoid, cholera, dysentery, htitis, giardiasis, polio, □ Legionnaires□ disease, and several gastrointestinal and influenza-like illnesses. Coliform bacteria are not considered pathogens though some strains are opportunistic pathogens, which mean they may cause disease among people whose local or general natural defense mechanisms are impaired. This is most likely among the elderly, the very young and the ill (such as burns or immunosuppressive therapy).
13. **Color**
    The AO for color in drinking water is □15 true color units (TCU). The provision of treated water at or below the AO will encourage rapid notification by consumers should problems leading to the formation of color arise in the distribution system.
14. **Conductivity**
    Conductivity is an indicator of the ionic content of water and is measured in microseimens/cm (us/cm). A level over 2000 us/cm is considered high and is unsuitable for watering plants.
15. **Copper (SCL: 1 mg/L)**
    Copper in drinking water normally is 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 an off taste. To many people, copper imparts a detectable taste at a concentration level of 1 mg/L. In instances where high copper concentration levels in the drinking water are observed, it is likely that other heavy metals are so present. Water containing 4 mg/L copper was found to impart a green tint to dyed hair.

16. **Fluoride**
    Fluoride levels over 1.5/L may cause discoloring or mottling of teeth. Levels between 1 and 1.5 mg/L will give teeth greater resistance to decay. At levels greater than 0.7 mg/L oral supplements are NOT recommended. If you have any questions or concerns, please contact our dental department or main office. 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. Caution: At concentrations above 1.8 mg/L, fluoride may cause staining of enamel of permanent teeth. This is most commonly a problem of children up to about 10 years old. Because this is the only effect, recently increased the MCL for fluoride. Crippling bone changes may occur in some people if drinking water is above 8 mg/L fluoride. There is not conclusive evidence that fluoride of fluoridation causes cancer in humans.
17. **Hardness**
    Water hardness is mainly caused by the presence of calcium and magnesium and is expressed as the equivalent quantity of calcium carbonate. Scale formation and excessive soap consumption are the main concerns with hardness. When heated, hard waters have a tendency to form scale deposits. Depending on the interaction of other factors such as pH and alkalinity, hardness levels between 80 and 100 mg/L are considered to provide an acceptable balance between corrosion and incrustation. Water supplies with hardness greater than 200 mg/L are considered poor but tolerable; those in excess of 500 mg/L are unacceptable for most domestic purposes. Because water softening may introduce undesirably high quantities of sodium into drinking water, it is recommended that a separate unsoftened supply be used for drinking and cooking. The aesthetic objective is set at a maximum of 500 mg/L.
18. **Hydrogen Sulfide (H2S)**
    Testing for H2S should occur on site. Imparts a rotten egg odor and taste that makes water all but undrinkable and also promotes corrosion. In addition, it can foul the resin bed of water conditioner. The use of a water conditioner is not recommended unless the water is first treated for removal of sulfur. The aesthetic objective for hydrogen sulfide is 0.05 mg/L.
19. **Hydrogen (OH)**
    Hydroxide contributes to 9 the total alkalinity of water. It is almost never present in natural waters. See Total Alkalinity.
20. **Iron (Fe)**
    At levels above 0.3 mg/L, iron stains laundry and plumbing fixtures and causes undesirable taste. The precipitation of excessive iron causes a reddish brown color in the water. It may also promote the growth of iron bacteria, leaving a slimy coating in the piping and toilet tanks. The presence of iron bacteria can also cause a □rotten egg' odor in the water and sheen on the surface of the water. The aesthetic objective is set at a minimum of 0.3 mg/L.
21. **Lead (MCL: 0.01 mg/L)**
    Exposure to lead in water, either brief or prolonged, can seriously injure health. Prolonged exposure to relatively small quantities (more than 0.01 mg/day) may affect health. Lead exposure occurs from air, food and water sources. All exposure is additive.

Lead accumulates in the bones, resulting in elevated levels in the 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 overexposure to lead. Health effects include reduced mental capacity (even mental retardation), interference with kidney and neurological functions and hearing loss in children. The proposed MCL should be followed whenever pregnant women, infants or children are consuming water. Water may be contaminated by lead from rocks and soil. However, most of Missouri has little lead in these sources and most of the water's pH is above neutral, where lead is less soluble. There is little reason to expect lead in water supplies. Lead pipe was used for service connections from water mains to homes or businesses as late as the 1960s. The use of solder containing lead has been made illegal for potable water plumbing systems. Industry standards now prevent the use of lead as an additive in solder used for plumbing.

22. **Magnesium (Mg)**
    Magnesium is present in all natural waters and high levels in groundwater are probably the result of contact with magnesium containing rock formations. Magnesium is a major contributor to water hardness and may also contribute undesirable tastes to drinking water. The aesthetic objective is set at a maximum of 200 mg/L.
23. **Manganese (Mn)**
    Manganese can cause staining to plumbing and laundry, and undesirable tastes in beverages. Also, it may lead to the accumulation of bacterial growth in the piping and toilet tanks. The aesthetic objective is set at a maximum of 0.05 mg/L.
24. **Mercury (MCL: 0.002 mg/L)**
    Mercury is distributed throughout the environment as a result of industrial and agricultural applications. Large increases in concentrations above natural levels in water, soils and air may occur in localized areas though significant mercury problems are rare in Missouri. 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.
25. **Nitrate (NO3)**
    The maximum acceptable concentration of nitrate in drinking water is 45 mg/L as NO3. In excessive amounts it contributes to the illness known as methemoglobinemia. Sources of nitrate in water include decaying plant or animal material, agricultural fertilizers, manure, domestic sewage or geological formations containing soluble nitrogen compounds.
26. **pH**
    Natural waters usually have pH values in the range of 4 to 9 and most are slightly basic (i.e. greater than 7) because of the presence of bicarbonates and carbonates. Corrosion effects may become significant as a pH below 6.5 and scaling may become a problem at a pH above 8.5. For this reason an acceptable range for drinking water pH is from 6.5 to 8.5.
27. **Potassium (K)**
    Potassium ranks seventh among the elements in order of abundance, yet its concentration

in most drinking waters seldom reaches 20 mg/L. There is no maximum acceptable concentration or aesthetic objective set for this element.

28. **Selenium (MCL: 0.01 mg/L)**
    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. Signs of toxicity have been seen at an estimated intake of 0.7 to 7 mg/day. Possible health effects include growth inhibition, skin discoloration, dental and digestive problems, liver damage, and psychological disorders. Some studies have raised concern over the possible carcinogenic properties of this element, but at this time it is not believed to be carcinogenic.
29. **Silver (MCL: 0.05 mg/L)**
    The need to set water standard for silver arises from its intentional addition to water as a disinfectant. (No public water system in Missouri uses silver as a disinfectant.) 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 tissue, a maximum level has been set. However, because skin discoloration is the only known health effect and because it is considered an aesthetic effect, has proposed making it a secondary standard.
30. **Sodium (Na)**
    Weathering of salt deposits and contact of water with igneous rock provide natural sources of sodium. Another potential source of sodium in water supplies is the water softening process, which replaces calcium and magnesium (hardness) with sodium. Persons on sodium restricted diets should consult with physicians. The aesthetic objective is set at a maximum of 200 mg/L.
31. **Sulfates (SO4)**
    Sulfate occurs naturally in water and may be present in natural waters in concentrations ranging from a few to several thousand mg/L. Concentrations in excess of 500 mg/L, especially if the magnesium content is also high, may have a laxative effect or cause gastrointestinal irritation. It may also result in a noticeable taste. The aesthetic objective is set at a maximum of 500 mg/L.
32. **Sum of Ions**
    Sum of ions indicates the concentration of ions in the water (i.e. dissolved solids). The aesthetic objective for total dissolved solids is a maximum of 500 mg/L.
33. **Tannins**
    Tannic acid is formed by decaying organic matter. Tannins alone are not harmful, although they can affect the proper operation of chemical free iron filters.
34. **Total Dissolved Solids (TDS)**
    Is a measure of the ability of a water to carry an electric current. This ability depends on the presence of ions and is therefore an indication of the concentration of ions (i.e. dissolved solids) in the water. Waters with high dissolved solids generally are of inferior palatability and also may leave a white film on dishes, etc. The aesthetic objective for total dissolved solids is 500 mg/L and is approximately equivalent to a conductivity of 500 uS/cm.
35. **Trihalomethane**
    THMs are formed in drinking water primarily as a result of chlorination and/or bromination of organic matter present naturally in raw water supplies. Chloroform is the THM detected most frequently and at the highest concentrations in drinking water. Available data are consistent with the hypothesis that ingestion of chlorinated drinking water, if not THMs specifically, may be casually related to cancers of the bladder and

colon (chloroform and other THMs account for up to 50% by weight of the total chlorination by-products in drinking water). Chloroform has been found to be carcinogenic in two animal species in the most extensive bioassays conducted to date and has been classified as being probably carcinogenic to humans.

36. **Turbidity**
    Turbidity in water is caused by suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble colored organic compounds, plankton and other microscopic organisms. Turbidity in excess of 5 NTU becomes apparent and may be objected to by a majority of consumers. Therefore, an AO of □ 5 NTU has been set for water at the point of consumption.
37. **Uranium2**
    Uranium is a naturally occurring element, consisting of a mixture of three radionuclide's, all of which decay by alpha emission. Uranium is used primarily as fuel in nuclear energy plants. It may enter drinking water from naturally occurring deposits or as a result of human activity, such as mill tailings and phosphate fertilizers. Nephritis is the primary chemically induced effect of uranium in animals and humans. Lesions are seen in the kidney at both glomerular and tubular levels. At sublethal levels, regeneration of the injured tubular epithelium begins two to three days after exposure. The MAC for uranium in drinking water, derived from the aDE, is 0.1mg/L.
38. **Zinc (SMCL: 5 mg/L)**
    Zinc is found in some natural waters, most frequently in areas where it is mined. It is not considered detrimental to health unless it occurs in very high concentrations. However, it does give an undesirable taste and appearance to drinking water, which is the reason for the secondary standard classification.