Near North Laboratories Inc.

Environmental Services
• Accredited by CAEAL/SCC to ISO/IEC 17025 for specific tests
• Licensed by the Ontario Ministry of Environment for Specific Drinking Water Analyses

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Excerpts from the Ministry of the Environment: Technical Support Document for Ontario Drinking-water Quality Standards, Objectives and Guidelines, June 2003

APPENDIX A – DESCRIPTION OF INDIVIDUAL PARAMETERS

Detailed supporting documentation for most of the parameters listed can be obtained through Health Canada at http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/doc_sup-ppui/index_e.html

Alkalinity (inorganic)

Alkalinity is a measure of the resistance of the water to the effects of acids added to water. The recommended operational range for alkalinity in coagulant-treated drinking water is 30 to 500 mg/L expressed as calcium carbonate. Alkalinity over 30 mg/L assists floc formation during the coagulation process. In some circumstances chemicals must be added to boost alkalinity before addition of a coagulant. Water with low alkalinity may tend to accelerate natural corrosion leading to "red water" problems whereas high alkalinity waters may produce scale incrustations on utensils, service pipes and water heaters. Water treatment processes, which do not use a coagulant generally, do not require alkalinity measurement or adjustment.

Calcium (inorganic)

Calcium is used as an indication of hardness. It is found naturally and used in some road salts. Excessive amounts cause scaling and greater soap consumption.

Chloride (inorganic)

Chloride is a common non-toxic material present in small amounts in drinking water and produces a detectable salty taste at the aesthetic objective level of 250 mg/L. Chloride is widely distributed in nature, generally as the sodium (NaCl), potassium (KCl) and calcium ($CaCl_2$) salts.

Conductivity (measured)

Conductivity is a measure of ionic activity (ability of water to conduct a current). It is used to verify chemistry results. Natural water ranges between 50 – 1500 us/cm.

Hardness (inorganic)

The operational guideline for hardness in drinking water is set at between 80 and 100 mg/L as calcium carbonate. This value is set to aid in water source selection where a choice exists. Hardness is caused by dissolved calcium and magnesium, and is expressed as the

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equivalent quantity of calcium carbonate. On heating, hard water has a tendency to form scale deposits and can form excessive scum with regular soaps. However, certain detergents are largely unaffected by hardness. Conversely, soft water may result in accelerated corrosion of water pipes. Hardness levels between 80 and 100 mg/L as calcium carbonate ($CaCO_3$) are considered to provide an acceptable balance between corrosion and incrustation. Water supplies with a hardness greater than 200 mg/L are considered poor but tolerable. Hardness in excess of 500 mg/L in drinking water is unacceptable for most domestic purposes (see the entry below for sodium).

Iron (inorganic)

Iron may be present in ground water as a result of mineral deposits and chemically reducing underground conditions. It may also be present in surface waters as a result of anaerobic decay in sediments and complex formation. The aesthetic objective for iron, set by appearance effects, in drinking water is 0.3 mg/L. Excessive levels of iron in drinking water supplies may impart a brownish colour to laundered goods, plumbing fixtures and the water itself; it may produce a bitter, astringent taste in water and beverages; and the precipitation of iron can also promote the growth of iron bacteria in water mains and service pipes. Iron based coagulants such as ferric sulfate can be highly effective in treatment processes at removing particles from water and leave very little residual iron in the treated water.

Magnesium (inorganic)

Magnesium is major component of hardness. High levels can cause discomfort with digestion.

Manganese (inorganic)

The colour related aesthetic objective for manganese in drinking water is 0.05 mg/L. Like iron, manganese is objectionable in water supplies because it stains laundry and fixtures black, and at excessive concentrations causes undesirable tastes in beverages. Manganese is present in some ground waters because of chemically reducing underground conditions coupled with presence of manganese mineral deposits. Manganese is also occasionally present, seasonally, in surface waters when anaerobic decay processes in sediments is occurring.

Nitrate (inorganic)

The maximum acceptable concentration of nitrates in drinking water is 10 mg/L as nitrogen. Nitrates are present in water (particularly ground water) as a result of decay of plant or animal material, the use of agricultural fertilizers, domestic sewage or treated wastewater contamination, or geological formations containing soluble nitrogen

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compounds. There is a risk that babies and small children may suffer blood related problems (methaemoglobinaemia) with excess nitrate intake. The nitrate ion is not directly responsible for this condition, but must first be reduced to the nitrite ion by intestinal bacteria. The nitrite reacts with the iron of haemoglobin in red blood cells which are then prevented from carrying oxygen to the body tissues.
Nitrate poisoning, in terms of methaemoglobinaemia, from drinking water appears to be restricted to susceptible infants. Older children and adults drinking the same water are unaffected. Most water-related cases of methaemoglobinaemia have been associated with the use of water containing more than 10 mg/L nitrate as nitrogen. In Canada, no cases of the condition have been reported where the nitrate concentration was consistently less than the maximum acceptable concentration. Where both nitrate and nitrite are present, the total nitrate plus nitrite-nitrogen concentration should not exceed 10 mg/L. In areas where the nitrate content of water is known to exceed the maximum acceptable concentration the public should be informed by the appropriate health authority of the potential dangers of using the water for infants.

pH (physical-chemical)

pH is a parameter that indicates the acidity of a water sample. The operational guideline recommended in drinking water is to maintain a pH between 6.5 and 8.5. The principal objective in controlling pH is to produce a water that is neither corrosive nor produces incrustation. At pH levels above 8.5, mineral incrustations and bitter tastes can occur. Corrosion is commonly associated with pH levels below 6.5 and elevated levels of certain undesirable chemical parameters may result from corrosion of specific types of pipe. With pH levels above 8.5, there is also a progressive decrease in the efficiency of chlorine disinfection and alum coagulation.

Sodium (inorganic)

The aesthetic objective for sodium in drinking water is 200 mg/L at which it can be detected by a salty taste. Sodium is not toxic. Consumption of sodium in excess of 10 grams per day by normal adults does not result in any apparent adverse health effects. In addition, the average intake of sodium from water is only a small fraction of that consumed in a normal diet. A maximum acceptable concentration for sodium in drinking water has, therefore, not been specified. Persons suffering from hypertension or congestive heart disease may require a sodium-restricted diet, in which case, the intake of sodium from drinking water could become significant. It is therefore recommended that the measurement of sodium levels be included in routine monitoring programs of water supplies. The local Medical Officer of Health should be notified when the sodium concentration exceeds 20 mg/L, so that this information may be passed on to local physicians.

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Softening using a domestic water softener increases the sodium level in drinking water and may contribute a significant percentage to the daily sodium intake for a consumer on a sodium restricted diet. It is recommended that a separate unsoftened supply be retained for cooking and drinking purposes.

Sulphate (inorganic)

The aesthetic objective for sulfate in drinking water is 500 mg/L. At levels above this concentration, sulfate can have a laxative effect, however, regular users adapt to high levels of sulfate in drinking water and problems are usually only experienced by visitors and new consumers. The presence of sulfate in drinking water above 150 mg/L may result in noticeable taste. The taste threshold concentration, however, depends on the associated metals present in the water. High levels of sulfate may be associated with calcium, which is a major component of scale in boilers and heat exchangers. In addition, sulfate can be converted into sulfide by some anaerobic bacteria creating odour problems and potentially greatly accelerating corrosion.

Tannins (organic)

Tannins may enter the water supply through the process of vegetable matter and vegetation degradation or through the wastes of the tanning industry. There is no set maximum limit. Presence of high concentrations of tannins may be reflective of surface water runoff contaminating a well.

Total Dissolved Solids (inorganic)

The aesthetic objective for total dissolved solids in drinking water is 500 mg/L. The term "total dissolved solids" (TDS) refers mainly to the inorganic substances dissolved in water. The principal constituents of TDS are chloride, sulphates, calcium, magnesium and bicarbonates. The effects of TDS on drinking water quality depend on the levels of the individual components. Excessive hardness, taste, mineral deposition or corrosion are common properties of highly mineralized water. The palatability of drinking water with a TDS level less than 500 mg/L is generally considered to be good.

Total Suspended Solids (inorganic)

Total suspended solids reflect particles in water greater then 1.5 micro meter in size. Total solids is the term applied to the material residue left in the vessel after evaporation of a sample and its subsequent drying in an oven at a defined temperature. Total solids include Total Suspended Solids (TSS), the portion of total solids retained by a filter, and Total Dissolved Solids (TDS), the portion that passes through the filter.

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Total Coliforms (microbiological)

The total coliform group consists of:

- all facultative anaerobic, Gram-negative, non-spore forming, rod-shaped bacteria that ferment lactose with gas formation within 48 hours at 35°C;

- many facultative anaerobic, Gram-negative, non-spore forming, rod-shaped bacteria that develop red colonies with a metallic (golden) sheen within 24 hours at 35°C on an Endo-type medium contain lactose; or,

- all bacteria possessing the enzyme β-galactosidase, which cleaves a chromogenic substrate (e.g. *ortho*-nitrophenyl- β-galactopyranoside), resulting in a release of a chromogen (*ortho*-nitrophenol).

These definitions are not identical but refer to three groups that are roughly equivalent. All three groups contain various species of the genera *Escherichia, Klebsiella, Enterobacte, Citrobacter, Serratia,* and many others.
The presence of any total coliform bacteria in water leaving a treatment plant or in any treated water immediately post treatment signifies inadequate treatment and is unacceptable. Corrective action needs to be taken.

Aerobic Bacteria – General Bacteria Population (GBP)

Aerobic bacteria is not considered harmful for drinking. For aesthetic purposes the GBP should not exceed 200 CFU/100 mL as counted from the total coliform test. However, when present, the well should be examined for structural faults and should be decontaminated. All wells should be monitored on a quarterly to semi-annual basis for coliform contamination.

Escherichia coli (microbiological)

Escherichia coli should not be detected/present in any drinking water sample. Escherichia coli is a fecal coliform and can be detected using methods such as membrane filtration, presence/absence and MPN. Since Escherichia coli is present in fecal matter and prevalent in sewage, but is rapidly destroyed by chlorine, it is a strong indicator of recent fecal pollution. Contamination with sewage as shown by positive E-coli tests would strongly suggest presence of pathogenic bacteria and viruses, as well as more chlorine resistant pathogens such as Giardia and Cryptosporidium, which are much more difficult to detect.