CADUCEON™

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CADUCEON GENERAL CHEMISTRY PACKAGES

PARAMETERS	UNITS	R.L.	ODWS		RESULTS			
			OBJECTIVE	TYPE OF OBJECTIVE	PRIVATE WELL PACKAGE #1	GENERAL CHEMISTRY PACKGE #2	POTABLE PACKGE #3	MAJOR IONS PACKAGE #4
Alkalinity(as CaCO3)	mg/L	1	30-500	OG	☐	☐	☐	☐
Conductivity	µS/cm	0.00-14.00	-	-	☐	☐	☐	☐
pH	T.C.U	1	6.5-8.5	OG	☐	☐	☐	☐
Colour	T.C.U	0.1	5	AO	☐	☐	-	-
Turbidity	N.T.U	0.01	1,5	MAC, AO	☐	☐	-	-
Ortho Phosphate (DRP)	mg/L	0.1	0.2	MAC	-	☐	-	-
Fluoride	mg/L	0.5	1.5	MAC	☐	☐	☐	☐
Chloride	mg/L	0.1	250	AO	☐	☐	☐	☐
Nitrite(N) NO2	mg/L	0.1	1.0	MAC	☐	☐	☐	☐
Nitrate(N) NO3	mg/L	1	10.0	MAC	☐	☐	☐	☐
Sulphate	mg/L	1	500	AO	☐	☐	☐	☐
Hardness(as CaCO3)	mg/L	0.02	80-100	OG	☐	☐	☐	☐
Calcium	mg/L	0.02	-	-	☐	☐	☐	☐
Magnesium	mg/L	0.02	-	-	☐	☐	☐	☐
Sodium	mg/L	0.2	200	AO	☐	☐	☐	☐
Iron	mg/L	0.005	0.30	AO	☐	☐	☐	☐
Manganese	mg/L	0.001	0.05	AO	☐	☐	☐	☐
Potassium	mg/L	0.1	-	-	☐	☐	☐	☐
Zinc	mg/L	0.005	5.0	AO	☐	☐	☐	-
Copper	mg/L	0.01	1.0	AO	☐	-	☐	-
Silica (SiO2)	mg/L	0.005	-	-	☐	☐	-	-
Ammonia(N) NH3	mg/L	0.01	-	-	☐	-	-	☐
TKN	mg/L	0.05	-	-	☐	-	-	-
Organic Nitrogen TKN-NH3	mg/L	0.05	0.15	OG	☐	-	-	-
Tannins	mg/L	0.1	-	-	☐	-	-	☐
DOC	mg/L	0.5	5	AO	☐	-	-	☐
Total Coliform	cts/100mL	-	0, b)	MAC	☐	-	-	-
E.coli	cts/100mL	-	0, a)	MAC	☐	-	-	-
Lead	mg/L	0.0002	0.01	MAC	CAN BE ADDED TO ANY PACKAGE			
Sulphide	mg/L	0.1	0.05	AO				

ODWS = ONTARIO DRINKING WATER STANDARDS, JUNE 2003
AO = AESTHETIC OBJECTIVE
MAC = MAXIMUM ACCEPTABLE CONCENTRATION
OG = OPERATIONAL GUIDELINE

- = NOT REQUESTED/ANALYZED
ND = NOT DETECTED
R.L. = REPORTING LIMIT

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WATER PARAMETER LIMITS & DESCRIPTIONS

MAC = MAXIMUM ALLOWABLE CONCENTRATION
OG = OPERATIONAL GUIDELINE
AO = AESTHETIC OBJECTIVE

MICROBIOLOGY

PARAMETER	LIMIT	UNITS	TYPE	WHAT YOU NEED TO KNOW
Total Coliform	0	CFU/100mL	MAC	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 Endotype 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 (orthonitrophenol). 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.
Escherichia Coli	0	CFU/100mL	MAC	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.

GENERAL CHEMISTRY

PARAMETER	LIMIT	UNITS	TYPE	WHAT YOU NEED TO KNOW
Ammonia	N/L	mg/L	N/A	No guideline; however, if ammonia levels exceed 0.1 mg/L as nitrogen, the possibility and type of contamination should be investigated. Ammonia is sometimes corrosive to Copper and its alloys and, as a result, may corride pipes.
Alkalinity	30-500	mg/L	OG	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	N/L	mg/L	N/A	Calcium is the fifth most abundant natural element. It enters the freshwater system through the weathering of rocks, especially limestone, and from the soil through seepage, leaching and runoff. Calcium is the largest contributing element to water hardness and is used in its calculation.

GENERAL CHEMISTRY

PARAMETER	LIMIT	UNITS	TYPE	WHAT YOU NEED TO KNOW
Chloride	250	mg/L	AO	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 (CaCl2) salts.
Colour	5	Total Colour Units (TCU)	AO	Colour (physical) The aesthetic objective for colour in drinking water is 5 TCU (True Colour Units). Water can have a faint yellow/brown colour which is often caused by organic materials created by the decay of vegetation. Sometimes colour may be contributed to by iron and manganese compounds produced by processes occurring in natural sediments or in aquifers. The presence of organic materials is the main cause of disinfection by-products when water is treated with chlorine.
Conductivity	N/L	uS/cm	N/A	Conductivity is a measure of the ability of water to pass an electrical current. Conductivity in water is affected by the presence of inorganic dissolved solids such as chloride, nitrate, sulfate, and phosphate anions (ions that carry a negative charge) or sodium, magnesium, calcium, iron, and aluminum Cations (ions that carry a positive charge). Conductivity can be used to estimate the total dissolved solids in water.
Dissolved Organic Carbon (DOC)	5	mg/L	AO	Dissolved Organic Carbon (DOC) (Organic) The aesthetic objective for dissolved organic carbon (DOC) in drinking water is 5 mg/L. High DOC is an indicator of possible water quality deterioration during storage and distribution due to the carbon being a growth nutrient for biofilm dwelling bacteria. High DOC is also an indicator of potential chlorination by-product problems. Coagulant treatment or high pressure membrane treatment can be used to reduce DOC.
Copper	1.0	mg/L	AO	The aesthetic objective for copper in drinking water is 1.0 mg/L. Copper occurs naturally in the environment but is rarely present in raw water. Copper is used extensively in domestic plumbing in tubing and fittings and is an essential trace component in food. Drinking water has the potential to be corrosive and to cause copper to dissolve in water. At levels above 1.0 mg/L, copper may impart an objectionable taste to the water. Although the intake of large doses copper has resulted in adverse health effects such as stomach upsets, the levels at which this occurs are much higher than the aesthetic objective.
Fluoride	1.5	mg/L	MAC	Where fluoride is added to drinking water, it is recommended that the concentration be adjusted to 0.5 - 0.8 mg/L, the optimum level for control of tooth decay. Where supplies contain naturally occurring fluoride at levels higher than 1.5 mg/L mg/L but less than 2.4 mg/L the Ministry of Health and Long-Term Care recommends an approach through local boards of health to raise public and professional awareness to control excessive exposure to fluoride from other sources. Levels above the MAC must be reported to the local Medical Officer of Health.
Iron	0.3	mg/L	AO	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.

GENERAL CHEMISTRY

PARAMETER	LIMIT	UNITS	TYPE	WHAT YOU NEED TO KNOW
Lead	0.01	mg/L	MAC	The maximum acceptable concentration for lead in drinking water is 0.01 mg/L. This applies to water at the point of consumption since lead is only present as a result of corrosion of lead solder, lead containing brass fittings or lead pipes which are found close to or in domestic plumbing and the service connection to buildings. Lead ingestion should be avoided particularly by pregnant women and young children, who are most susceptible. It is recommended that only the cold water supply be used for drinking/consumption and only after five minutes of flushing to rid the system of standing water. Corrosion inhibitor addition or other water chemistry adjustments may be made at the treatment plant to reduce lead corrosion rates where necessary.
Magnesium	N/L	mg/L	N/A	Magnesium is the eighth most abundant natural element. It enters the freshwater system through the weathering of rocks, especially limestone, and from the soil through seepage, leaching and runoff. Magnesium is the second largest contributing element to water hardness and is used in its calculation.
Manganese	0.05	mg/L	AO	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.
Nitrite as Nitrogen (N02)	1.0	mg/L	MAC	The maximum acceptable concentration of nitrite in drinking water, 1.0 mg/L as nitrogen, is based, as with nitrate, primarily on the relationship between nitrite in water and the incidence of infantile methaemoglobinaemia. Nitrite is fairly rapidly oxidized to nitrate and is therefore seldom present in surface waters in significant concentrations. Nitrite may occur in ground water, however if chlorination is practiced the nitrite will usually be oxidized to nitrate.
Nitrate as Nitrogen (N03)	10.0	mg/L	MAC	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 compounds. There is a risk that babies and small children may suffer blood related problems (methaemoglobinaemia "Blue Baby Syndrome") 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.
Ortho-Phosphate	0.2	mg/L	MAC	No guideline, however, 0.2 mg/L as phosphorus is recommended. Not commonly toxic, but may produce taste or odour. Major sources are municipal/industrial effluent, agricultural run-ff, and domestic sewage (i.e. septic tank seepage).

GENERAL CHEMISTRY

PARAMETER	LIMIT	UNITS	TYPE	WHAT YOU NEED TO KNOW
pH	6.5-8.5	no units	OG	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.
Potassium	N/L	mg/L	N/A	Potassium is an essential element in humans, and is not normally found in drinking water at levels that could be a concern to human health. However, the consumption of drinking water treated by water softeners using potassium chloride may significantly increase exposure to potassium. This is not a concern for the general population. However, increased exposure to potassium could result in significant health effects in people with kidney disease or other conditions, such as heart disease, coronary artery disease, hypertension, diabetes, and who are taking medication that interfere with normal body potassium handling.
Sodium	200	mg/L	AO	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. 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.
Sulphide	0.05	mg/L	AO	The odour related aesthetic objective for sulfide in drinking water is 0.05 mg/L as H2S (hydrogen sulphide). Although ingestion of large quantities of hydrogen sulfide gas can produce toxic effects on humans, it is unlikely that an individual would consume a harmful dose in drinking water because of the associated unpleasant taste and odour. Sulfide is also undesirable in water supplies because, in association with iron, it produces black stains on laundered items and black deposits on pipes and fixtures. Lower levels of sulfide can be removed effectively from most well water by aeration. Sulfide is oxidized to sulfate in well-aerated waters over a period of hours and consequently sulfide levels in surface supplies are usually very low.
Sulphate	500	mg/L	AO	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.

GENERAL CHEMISTRY

PARAMETER	LIMIT	UNITS	TYPE	WHAT YOU NEED TO KNOW
Silica (SiO_2)	N/L	mg/L	N/A	No guideline, but 1-30mg/L is normal. The major source is geological formations, although fluoridation of drinking water and aerosols are also significant sources.
Turbidity	5	Nephelometric Turbidity Units (N.T.U.)	AO	Turbidity (physical) Control of turbidity in drinking-water systems is important for both health and aesthetic reasons. The substances and particles that cause turbidity can be responsible for significant interference with disinfection, can be a source of disease-causing organisms and can shield pathogenic organisms from the disinfection process. Turbidity is an important indicator of treatment efficiency and the efficiency of filters in particular. A significant relationship has been demonstrated between turbidity increases and the number of Giardia cysts and Cryptosporidium oocysts breaking through filters. Operational Guidelines for turbidity as an indicator of the efficiency of filters in relation to credits for Giardia cysts and Cryptosporidium oocysts removal have been provided in the “Procedure for Disinfection of Drinking Water in Ontario”. The effect of turbidity on disinfection efficiency, including potential for disinfection byproducts, is related to the type and nature of the particles in the water. A raw water supply which is surface water or ground water under direct influence of surface water is likely to contain organic particles that cause turbidity and adversely affect disinfection efficiency. A significant factor in the formation of disinfection by-products is the organic or humic component of turbidity. Raw water supply which is ground water with very low organic content may contain inorganicbased turbidity, which may not seriously hinder disinfection. For such waters, an Operational Guideline for turbidity is not established. Since ground water quality is inherently stable, any significant variation in turbidity, excluding pump startup, should be investigated and analyzed immediately for the potential of surface water influence and the presence of organic particles. Inorganic turbidity formed during the disinfection process or post-disinfection treatment processes through oxidation and chemical participation would not likely interfere with disinfection effectiveness. Therefore the most meaningful location for taking a turbidity sample is before the disinfection process and where applicable after filtration. Turbidity in excess of 5.0 NTU becomes visible to the naked eye and as such a majority of consumers may object to its presence. Therefore, an aesthetic objective of 5.0 NTU has been set for all waters at the point of consumption.
Organic Nitrogen/Total Kjeldahl Nitrogen (TKN)	0.15	mg/L	OG	The operational guideline for organic nitrogen in drinking water is 0.15 mg/L. Organic nitrogen is calculated by the difference between the total Kjeldahl nitrogen and the ammonia nitrogen. High levels may be caused by septic tank or sewage effluent contamination. This form of contamination is often associated with some types of chlorine- worsened taste problems. Organic nitrogen at levels above 0.15 mg/L would be typically associated with DOC contribution of 0.6 mg/L. Organic nitrogen compounds frequently contain amine groups which can react with chlorine and severely reduce its disinfectant power. Certain chlorinated organic nitrogen compounds may be responsible for flavour problems that are associated with chlorophenol. Taste and odour problems are common with organic nitrogen levels greater than 0.15 mg/L.
Tannins	N/L	mg/L	N/A	Tannin and lignin are part of a natural group of organic substances in soil, produced by decaying vegetation. Tannin and lignin can impart a yellow or light brown colour, bitter taste, and unpleasant odour in drinking water. The characteristics of iron, iron bacteria, and humic substances can be very similar in drinking water. It is important to determine which ofthese is causing water problems, because the treatment options are very different. Chlorine can be used to treat iron and iron bacteria, but chlorine added to water containing humic substances may contribute to the formation of Trihalomethanes (THM)s
Zinc	5.0	mg/L	AO	The taste related aesthetic objective for zinc in drinking water is 5.0 mg/L. The concentration of zinc may be considerably higher at the consumer's tap in standing water because of corrosion taking place in galvanized pipes, but this can be cleared easily by brief flushing. Corrosion control using small concentrations of zinc based inhibitors has been found effective in some water systems.