

Drinking Water Quality and Compliance

City of Saskatoon – for Year 2019

Annual Notice to Consumers

1.0 Introduction

The Water Security Agency (WSA) requires waterworks owners to provide notification at least once each year to consumers on the quality of water produced and supplied. The information is to include the performance of the waterworks, as documented by water sampling required by a Minister's Order or Permit to Operate a Waterworks. The following is a summary of the City of Saskatoon's water quality and sample submission compliance records for 2019.

Readers should refer to the WSA's *Municipal Drinking Water Quality Monitoring Guidelines, March 2016, EPB 202* for more information on minimum sample submission requirements. Permit requirements for a specific waterworks may require more sampling than outlined in the department's monitoring guidelines. Detailed information on the nature and significance of specific water tests is available at <http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/index-eng.php>.

2.0 Water Quality Standards – Bacteriological Quality

Bacteriological determination has been a standard monitoring tool for many years, particularly using total coliform bacteria as an indicator of the potential presence of pathogens. Bacteriological water quality monitoring is required for systems supplying water for human consumptive use or hygienic use. Sampling locations are intended to be at representative locations in the distribution system. Samples include reservoir samples and those obtained during routine distribution sampling.

Table 1: Bacteriological Sampling

Parameter	Limit	Regular Samples Required	Regular Samples Tested	# Positive Regular Tested (%)
Total Coliform	0 cfu/100mL	1,248	2,796	0 %
Background Bacteria*	<200 cfu/100mL	1,248	2,796	0 %

cfu – colony forming units or organisms

"<" – less than

*Regarded in this report as non-Coliform bacteria when membrane filtration method used.

3.0 Water Disinfection – Chlorine Residual in Distribution System for Test Results Analyzed with Bacteriological Samples

A minimum of 0.1 mg/L free chlorine residual **OR** 0.5 mg/L total chlorine residual is required at all times throughout the distribution system unless otherwise approved. The City of Saskatoon employs chloramination, therefore total chlorine residual samples are collected from the distribution system at the same time and frequency as bacteriological water quality samples.

Table 2: Chlorine Residual Sampling in Distribution

Parameter	Minimum Limit (mg/L)	Total Chlorine Residual Range (mg/L)	# Tests Required	# Tests Performed	% Adequate Chlorine (% Passed)
Chlorine Residual	0.1 mg/L free or 0.5 mg/L total	0.88 – 2.68	1,248	2,796	100%

4.0 Water Disinfection – Total Chlorine Residual for Water Entering the Distribution System – From Water Treatment Plant Records

A minimum of 0.5 mg/L total chlorine residual is required for water entering the distribution system, as indicated in the City of Saskatoon’s Permit to Operate. Tests for free and total chlorine are performed on a daily basis by the waterworks operators and are recorded in operation records. Continuous online monitoring is also done for this parameter and is compared to discrete data on a daily, weekly, and as required basis to ensure accuracy. Data presented in Table 3 is from online continuous monitoring and discrete daily testing conducted by the Accredited Water Treatment Plant (WTP) Water Lab.

Table 3: Total Chlorine Residual Sampling Entering Distribution

Parameter	Limit (mg/L)	Chlorine Residual (mg/L)		# Tests Required	# Tests Performed	# Tests Not Meeting Requirements
Total Chlorine Residual as measured by online monitors	> 0.5	Sensor Test Level Range 0 – 5		Continuous	Continuous	N/A
Total Chlorine Residual Lab measured	> 0.5	MIN	1.70	52	365	0
		MAX	2.55			
		AVG	2.00			

“>” – greater than

5.0 Turbidity – On-site

Turbidity is an important water quality parameter indicating general water quality and treatment process performance. High turbidity values may indicate the potential presence of bacteria. Depending on the composition of the turbidity, interference with chlorination can range from negligible to severe. Staff at the City of Saskatoon WTP continuously monitor the turbidity of all filters and outgoing water into the distribution system. Monitoring is also conducted on discrete samples taken daily by the WTP Water Lab.

Table 4: Turbidity Sampling

Parameter	Limit (NTU)	Sample Turbidity (NTU)		# Tests Required	# Tests Performed	# Tests Not Meeting Requirements
Turbidity as measured by online monitors	< 0.3 (95% of time) 1.0 (Never to exceed)	Sensor Test Level Range 0 -2		Continuous	Continuous	N/A
Turbidity Lab measured	1.0	MIN	0.07	52	365	0
		MAX	0.17			
		AVG	0.10			

NTU – Nephelometric Turbidity Unit

“<” – less than

“>” – greater than

6.0 Fluoride – On and Off-site Monitoring

Fluoride is monitored on-site at the WTP and off-site at select representative routine sampling locations in the distribution system, including reservoirs. Fluoride is often added to drinking water for the prevention of tooth decay. Fluoride is added to a dosage of 0.7 mg/L residual Fluoride as per the Permit to Operate and is based on the Health Canada Guideline for Fluoride addition. The table below shows data from the Accredited WTP Water Lab. Continuous monitoring is also performed on-site at the WTP.

Table 5: Fluoride Sampling

Sampling Location	Fluoride Limit (mg/L)	Sample Result (average) (mg/L)	# Samples Required	# Samples Submitted
Water Treatment Plant	1.5	0.67	Daily	365
Acadia Reservoir	1.5	0.67	52 from all sites combined	51
42 nd Street Reservoir	1.5	0.68		102
Distribution System	1.5	0.67		309

7.0 Chemical – General (Major Ions)

The composition and concentration of general chemicals identify the water’s chemical composition. This will vary among supply sources. Samples are collected from treated water at the WTP and submitted on a quarterly basis (January, April, July, and October).

Table 6: Chemical Sampling - General (Major Ions)

Parameter	Aesthetic Objectives (mg/L)	Sample Results (mg/L)	# Samples Required (one per three months)	# Samples Submitted
Alkalinity	500	123	4	8
Bicarbonate	None	150	4	8
Calcium	None	38	4	8
Carbonate	None	<5.0	4	8
Chloride	250	16	4	8
Conductivity (µS/cm)	None	464	4	8
Hardness (as CaCO ₃)	800	176	4	8
Magnesium	200	17	4	8
Nitrate (as NO ₃)	45.0*	0.68	4	8
pH	7.0 to 10.5	8.1	4	8
Sodium	200	26	4	8
Sulphate	500	88	4	8
Total Dissolved Solids	500	270	4	8

Note: * MAC value – Maximum Acceptable Concentration
 “<” – less than

***Objectives apply to certain characteristics of or substances found in water for human consumptive or hygienic use. The presence of these substances will affect the acceptance of water by consumers and/or interfere with the practice of supplying good quality water. Compliance with drinking water aesthetic objectives is not mandatory as these objectives are in the range where they do not constitute a health hazard. The aesthetic objectives for several parameters (including hardness as CaCO₃, magnesium, sodium and total dissolved solids) consider regional differences in drinking water sources and quality.*

8.0 Chemical – Health and Toxicity

Substances within the Chemical Health category may be naturally occurring in drinking water sources or may be the result of human activities. These substances may represent a long-term health risk if the Maximum Acceptable Concentration (MAC) or Interim Maximum Acceptable Concentration (IMAC) is exceeded.

Samples for chemical health analysis are collected from treated water leaving the WTP and are submitted on a quarterly basis (January, April, July, and October).

Table 7: Chemical Sampling - Health and Toxicity

Parameter	Limit MAC (mg/L)	Limit IMAC (mg/L)	Sample Results (mg/L)	# Samples Exceeding Limits	# Samples Required (one per six months)	# Samples Submitted
Aluminum		0.1*	0.020	0	2	8
Antimony		0.006	0.00015	0	2	8
Arsenic		0.010	0.00027	0	2	8
Barium	1.0		0.054	0	2	8

Parameter	Limit MAC (mg/L)	Limit IMAC (mg/L)	Sample Results (mg/L)	# Samples Exceeding Limits	# Samples Required (one per six months)	# Samples Submitted
Boron	5.0		0.026	0	2	8
Cadmium	0.005		<0.000020	0	2	8
Chromium	0.050		<0.0010	0	2	8
Copper		2.0	0.0034	0	2	8
Iron		0.3*	<0.060	0	2	8
Lead	0.005		<0.00020	0	2	8
Manganese		0.05*	<0.0040	0	2	8
Selenium	0.010		0.00039	0	2	8
Silver	None	none	<0.00010	0	2	8
Uranium	0.020		0.0013	0	2	8
Zinc		5.0*	<0.0037	0	2	8

MAC – Maximum Acceptable Concentration, IMAC – Interim Maximum Acceptable Concentration

*Operational guideline values

Note: “<” values are considered to be below detection limits.

9.0 Chemical – Cyanide and Mercury

Mercury enters water supplies naturally and as a result of human activities. Cyanide can enter source waters as a result of industrial effluent or spill events. The levels of both cyanide and mercury in groundwater and surface water tend to be very low. These substances may represent a long-term health risk if the MAC is exceeded.

Table 8: Chemical Sampling - Cyanide and Mercury

Parameter	Limit MAC (mg/L)	Sample Results (mg/L)	# Samples Exceeding Limits	# Samples Required (one per six months)	# Samples Submitted
Cyanide	0.2	<0.0020	0	2	8
Mercury	0.001	<0.0000050	0	2	8

Note: “<” values are considered to be below detection limits.

MAC – Maximum Acceptable Concentration

10.0 Chemical – Trihalomethanes and Haloacetic Acids

Trihalomethanes (THM) and Haloacetic Acids (HAA) are generated during the water disinfection process as a by-product of reactions between chlorine and organic material. THM and HAA are generally found only in drinking water obtained from surface water supplies disinfected by chlorine. THM and HAA are to be monitored from two different representative locations at the extremities of the distribution system every three months.

Table 9: Chemical Sampling - THMs and HAAs

Parameter	Limit (mg/L)	Sample Result (average) (mg/L)	# Samples Required	# Samples Submitted
THM – at WTP	0.1	0.038	n/a	12
THM – in Distribution System	0.1	0.050	8	12
HAA – at WTP	0.08	0.025	n/a	12
HAA – in Distribution System	0.08	0.030	8	12

11.0 Chemical – Synthetic Organic Chemicals

It is expected that the detection of the many synthetic organic chemicals in Saskatchewan's groundwater and surface water would be very rare. Detection of any of these chemicals would most likely be associated with a site-specific pollution event.

Nitritotriacetic Acid (NTA) is most commonly used to replace phosphates in laundry detergents. As a result, the main source of NTA to the aquatic environment is via industrial or municipal liquid effluents. Because of rapid NTA degradation in most sewage treatment processes, effluent concentrations are usually very low.

Table 10: Chemical Sampling - Synthetic Organic Chemicals

Parameter	Limit MAC (mg/L)	Sample Results (mg/L)	# Samples Exceeding Limits	# Samples Required	# Samples Submitted
Carbon Tetrachloride	0.002	<0.00050	0	1	1
1,2 Dichlorobenzene	0.200	<0.00050	0	1	1
1,4 Dichlorobenzene	0.005	<0.00050	0	1	1
1,2 Dichloroethane	0.005	<0.00050	0	1	1
1,1 Dichloroethene	0.014	<0.00050	0	1	1
Dichloromethane	0.050	<0.00050	0	1	1
2,4 Dichlorophenol	0.900	<0.00050	0	1	1
Monochlorobenzene	0.08	<0.00050	0	1	1
Tetrachloroethene	0.01	<0.00050	0	1	1
2,3,4,6 Tetrachlorophenol	0.1	<0.00050	0	1	1
Trichloroethene	0.005	<0.0010	0	1	1
2,4,6 Trichlorophenol	0.005	<0.00050	0	1	1
Vinyl chloride	0.002	<0.00050	0	1	1
NTA	0.4	<0.20	0	1	1

MAC – Maximum Acceptable Concentration

Note: "<" values are considered to be below detection limits.

12.0 Chemical – Volatile Organic Chemicals

Due to the volatile nature of these chemicals, concentrations in surface water are generally low. Detectable values in groundwater are normally associated with site-specific pollution sources particularly the petroleum industry.

Table 11: Chemical Sampling - Volatile Organic Chemicals

Parameter	Limit MAC (mg/L)	Sample Results (mg/L)	# Samples Exceeding Limits	# Samples Required	# Samples Submitted
Benzene	0.005	<0.00050	0	1	1
Ethylbenzene	0.14	<0.00050	0	1	1
Toluene	0.06	<0.00050	0	1	1
Xylenes	0.090	<0.00050	0	1	1

MAC – Maximum Acceptable Concentration

Note: “<” values are considered to be below detection limits.

13.0 Benzo(a)Pyrene, Perfluorooctane Sulfonate and Perfluorooctanoic Acid

Benzo(a)Pyrene (BaP) is generated by the incomplete combustion of organic material and is generally associated with industrial atmospheric discharges and automobile exhaust. It may also be found in source waters that received treated wastewater effluents. Surface water near industrialized areas is more susceptible to BaP contamination. Perfluorooctane Sulfonate (PFOS) and Perfluorooctanoic Acid (PFOA) are found in similar locations but are also found in locations affected by land spreading of septic tank waste as well as land or water affected by Aqueous Film-Forming Foam.

Table 12: BaP, PFOS, and PFOA Sampling

Parameter	Limit MAC (mg/L)	Sample Results (mg/L)	# Samples Exceeding Limits	# Samples Required	# Samples Submitted
BaP	0.00001	<0.0000050	0	1	1
PFOS	0.0006	<0.000050	0	1	1
PFOA	0.0002	<0.000050	0	1	1

MAC – Maximum Acceptable Concentration

Note: “<” values are considered to be below detection limits.

14.0 Chemical – Pesticides

The potential for pesticide detection may vary seasonally and so sampling is to be conducted during the summer months of late June, July, or August. Samples are collected from the treated water leaving the WTP.

Table 13: Chemical Sampling - Pesticides

Parameter	Limit MAC (mg/L)	Sample Results (mg/L)	# Samples Exceeding Limits	# Samples Required	# Samples Submitted
Atrazine	0.005	<0.00010	0	1	1
Bromoxynil	0.005	<0.00010	0	1	1
Carbofuran	0.09	<0.00010	0	1	1
Chlorpyrifos	0.09	<0.00010	0	1	1
Dicamba	0,12	<0.00010	0	1	1
2,4-D	0.10	<0.00010	0	1	1
Diclofop-methyl	0.009	<0.00010	0	1	1
Dimethoate	0.2	<0.00010	0	1	1
Glyphosate	0.28	<0.0050	0	1	1

Parameter	Limit MAC (mg/L)	Sample Results (mg/L)	# Samples Exceeding Limits	# Samples Required	# Samples Submitted
Malathion	0.19	<0.00010	0	1	1
MCPA	0.10	<0.00010	0	1	1
Pentachlorophenol	0.06	<0.00010	0	1	1
Picloram	0.19	<0.00010	0	1	1
Trifluralin	0.045	<0.00010	0	1	1

Note: "<" values are considered to be below detection limits.

MAC – Maximum Acceptable Concentration

15.0 Microcystins Toxins

Microcystins are a type of toxin produced by cyanobacteria (blue-green algae). Microcystins are considered to be toxic to the liver and are produced as a result of cyanobacterial blooms in surface water sources in Saskatchewan. Microcystin-LR is a secondary metabolite and has been found to be the most frequently occurring form of cyanobacterial toxin. Elevated toxin concentrations are most often encountered during the die-off of heavy algal blooms in a raw water surface water supply. Samples should be collected and analyzed on a monthly basis during periods when algae blooms on surface water sources occur. The WTP analyzes samples monthly during the period of June to October.

Table 14: Microcystins Toxins Sampling

Parameter	Limit MAC (mg/L)	Sample Results (mg/L)	# Samples Exceeding Limits	# Samples Required	# Samples Submitted
Microcystin-LR	0.0015	<0.00020	0	5	5

MAC – Maximum Acceptable Concentration

Note: "<" values are considered to be below detection limits.

16.0 Radiological

Radionuclides are derived from natural sources such as weathering of rocks that contain radioactive substances and by man-made sources. Most radionuclides readily adhere to sediments and do not occur in significant amounts in the water column. In Saskatchewan, radionuclide contamination of water supplies is uncommon and tends to be very site specific. Gross alpha and gross beta are initial water quality screening tests used to determine the overall quality of drinking water for a larger set of specific parameters. Further sampling may be required if gross alpha or beta exceedances are found. Waterworks serving a population greater than 100,000 people are required to perform annual monitoring on all of the isotopes listed in the chart below.

Table 15: Radiological Sampling

Parameter	Limits (Becquerels/L)	Sample Results (Bq/L)	# Samples Exceeding Limits	# Samples Required	# Samples Submitted
Gross Alpha	0.5	<0.16	0	1	1
Gross Beta	1.0	0.19	0	1	1
Cesium-137	10	<0.1	0	1	1

Parameter	Limits (Becquerels/L)	Sample Results (Bq/L)	# Samples Exceeding Limits	# Samples Required	# Samples Submitted
Iodine-131	6	<0.3	0	1	1
Lead-210	0.2	<0.02	0	1	1
Potassium-40	-	<2	0	1	1
Radium-226	0.5	0.01	0	1	1
Strontium-90	5	<0.05	0	1	1
Tritium	7000	15	0	1	1

Note: Becquerel – a unit to measure radioactivity.

Also “<” values are considered to be below detection limits.


17.0 Protozoa: *Giardia* and *Cryptosporidium*

Giardia and *Cryptosporidium* are small protozoan organisms which when ingested can result in severe gastrointestinal illness. Raw water monitoring requirements for water entering a water treatment plant are part of a larger treatment plan based on a 3-log reduction in and/or inactivation of cysts and oocysts. The establishment of Maximum Acceptable Concentration for these protozoa in drinking water is not possible at this time for several reasons but primarily as routine analytical methods available for the detection of cysts and oocysts suffer from low recovery rates. A health based 3-log reduction treatment goal has been established as a means to manage potential protozoan contamination of drinking water supplies.

The City of Saskatoon WTP utilizes conventional treatment processes combined with Ultra Violet treatment as a multi-barrier approach to ensure a 4-log inactivation of *Giardia* and *Cryptosporidium*.

Table 16: Protozoa Sampling

Parameter	Sample Results (Samples are from RAW un-treated water)	# Samples Exceeding Limits	# Samples Required	# Samples Submitted
<i>Giardia</i>	1.6 cysts/100 L	n/a	4	4
<i>Cryptosporidium</i>	0.0 oocysts/100 L	n/a	4	4



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