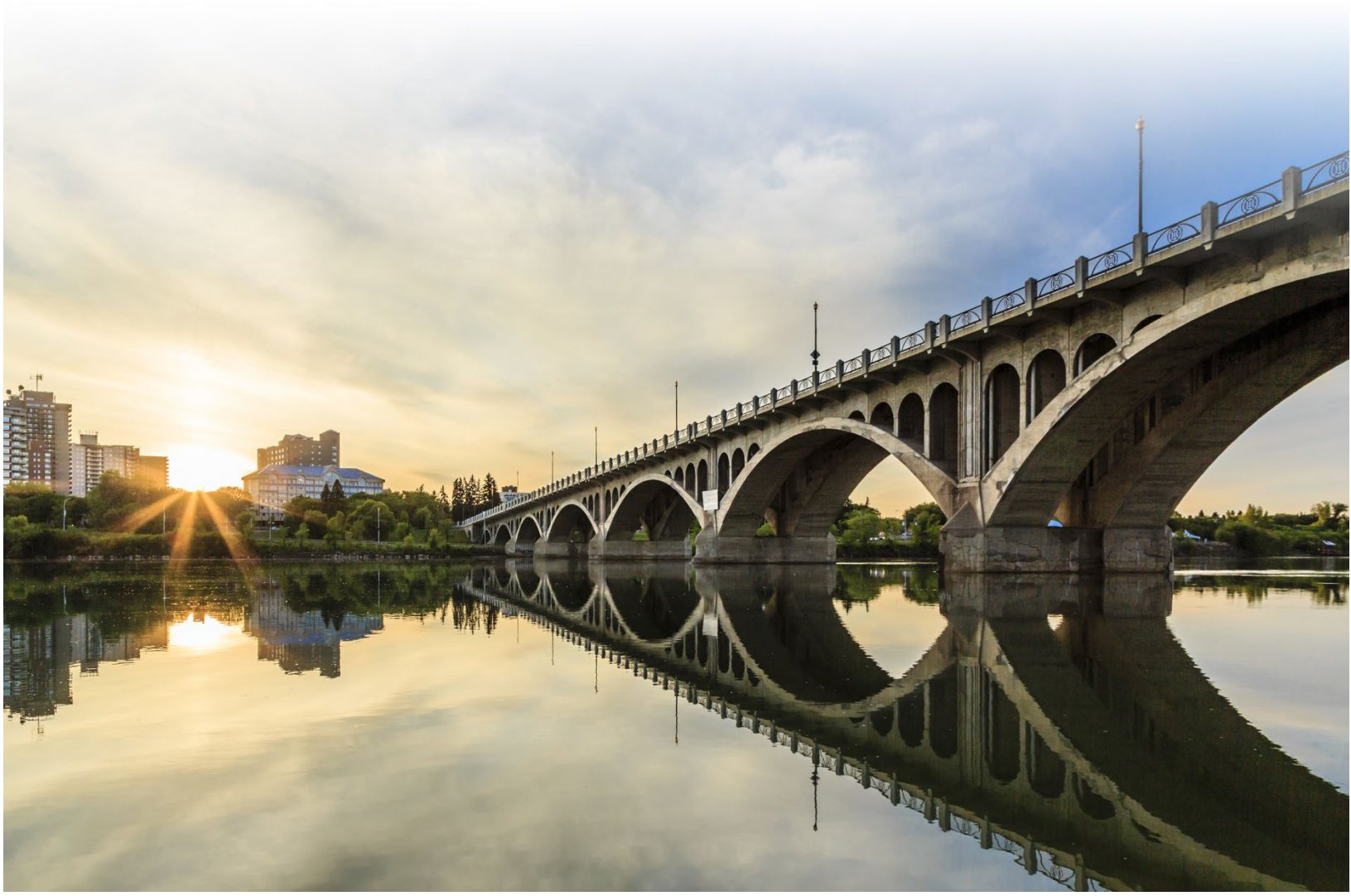
City of Saskatoon
Saskatoon Water

DRINKING WATER QUALITY AND COMPLIANCE

Annual Notice to Consumers 2021

WT: 430-2
March 7, 2022



1.0 Introduction

The Saskatchewan Water Security Agency (WSA) and Ministry of Environment requires waterworks owners to provide notification to consumers at least once each year on the quality of water that is 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 report is a summary of the City of Saskatoon's water quality and sample submission compliance records for 2021.

Readers should refer to the WSA's *Municipal Drinking Water Quality Monitoring Guidelines, October 2020, EPB 202* for more information on minimum sample submission requirements. Permit requirements for a specific waterworks may require more sampling than is 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/100 mL	1248	1782	0
Background Bacteria*	<200 cfu/100 mL	1248	1782	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

Unless otherwise approved, 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. The City of Saskatoon employs chloramination, which converts free chlorine to total chlorine; therefore, chlorine residual is measured as Total Chlorine. Samples are collected from the distribution system at the same time and frequency as the 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	0.34 – 2.26	1248	1782	99.9*

**One sample was obtained below the minimum. This sample yielded a value of 0.34 mg/L total chlorine. Hydrant flushing was performed, and the residual chlorine returned to typical values above the mandated value.*

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

As specified in the City of Saskatoon's Permit to Operate, a minimum of 0.5 mg/L total chlorine residual is required for water entering the distribution system. Tests for free and total chlorine are performed on a daily basis by the waterworks operators and are recorded in the 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 that is conducted by the Water Lab at the Water Treatment Plant which is accredited by CALA to ISO/IEC 17025 for the tests found on the laboratory's scope of testing.

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	1*
Total Chlorine Residual Lab measured	>0.5	MIN	1.39	52	365	0
		MAX	2.35			
		AVG	**1.88**			

">" – greater than

**On the night of August 4th and into the morning of August 5th, the WTP experienced a breakdown of the ammonia pumping system. Although the issues have since been resolved, it was noted from investigations that during the incident, measured total chlorine levels were below PTO limits for a duration of four hours.*

5.0 Turbidity – (on site)

Due to effects on bacteriological quality and treatment performance, turbidity is an important water quality parameter. 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 that are 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	1*
Turbidity Lab measured	1.0	MIN	0.061	52	365	0
		MAX	0.200			
		AVG	0.107			

NTU – Nephelometric Turbidity Unit
"<" – less than
">" – greater than
**The turbidity on one filter measured over 1 NTU for 32 seconds due to a valve leak during a backwash on September 4th. Water was measured over 1 NTU using the online meters only. All other processes were operating properly and subsequent testing showed no measurable effect from the event.*

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	0.66	Daily	365
Acadia Reservoir	1.5	0.66	52 from all sites combined	52
42nd Street Reservoir	1.5	0.66		103
Distribution System	1.5	0.65		408

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. Duplicate 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 (1 per 3 months)	# Samples Submitted
Alkalinity	500	132	4	8
Bicarbonate	No Objective	141	4	8
Calcium	No Objective	34	4	8
Carbonate	No Objective	<1.0	4	8
Chloride	≤ 250	14	4	8
Conductivity (µS/cm)	No Objective	426	4	8
Hardness (as $CaCO_3$)	800	158	4	8
Magnesium	200	18	4	8
Nitrate (as N)	10*	0.14	4	8
pH	7.0 to 10.5	8.2	4	8
Sodium	≤ 200	25	4	8
Sulphate	≤ 500	85	4	8
Total Dissolved Solids	≤ 500	250	4	8

*Note: * MAC value – Maximum Acceptable Concentration*
"<" – less than; "≤" – less than or equal to

Objectives apply to certain characteristics of 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 $CaCO_3$, 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, as duplicates, 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 (1 per 6 months)	# Samples Submitted
Aluminum		0.1*	0.028	0	2	8
Antimony	0.006		0.00016	0	2	8
Arsenic	0.010		0.000396	0	2	8
Barium	1.0		0.046	0	2	8
Boron	5.0		0.025	0	2	8
Cadmium	0.005		<0.0000050	0	2	8
Chromium	0.05		<0.00050	0	2	8
Copper	2.0	1.0*	0.0022	0	2	8
Iron		≤ 0.3	<0.010	0	2	8
Lead	0.005		<0.000050	0	2	8
Manganese	0.12	≤ 0.02	0.00028	0	2	8
Selenium	0.01		0.00037	0	2	8
Silver	None		<0.000010	0	2	8
Uranium	0.02		0.0010	0	2	8
Zinc		≤ 5.0	<0.0030	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 (1 per 6 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 (THM) and Haloacetic Acids (HAA)

Trihalomethanes and Haloacetic Acids are generated during the water disinfection process as a by-product of reactions between chlorine and organic material. Trihalomethanes and Haloacetic Acids are generally found only in drinking water that is obtained from surface water supplies that are 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	0.100	0.034	n/a	12
THM – in Distribution System	0.100	0.035	8	12
HAA – at WTP	0.080	0.017	n/a	12
HAA – in Distribution System	0.080	0.017	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.

Nitrilotriacetic 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	0.005	<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	<0.0010	0	1	1
1,1 Dichloroethene	0.014	<0.00050	0	1	1
Dichloromethane	0.050	<0.0010	0	1	1
2,4 Dichlorophenol	0.900	<0.00020	0	1	1
Monochlorobenzene	0.080	<0.00050	0	1	1
2,3,4,6 Tetrachlorophenol	0.100	<0.00050	0	1	1
Trichloroethene	0.050	<0.00050	0	1	1
2,4,6 Trichlorophenol	0.005	<0.00030	0	1	1
Vinyl chloride	0.002	<0.00050	0	1	1
NTA	0.4	<0.20	0	0	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	0.140	<0.00050	0	1	1
Toluene	0.600	<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 (BaP), Perfluorooctane Sulfonate (PFOS) and Perfluorootanoic Acid (PFOA)

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. PFOS and PFOA are found in similar locations but are also found in locations that are affected by land spreading of septic tank waste and 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
Benzo(a)pyrene	0.00001	<0.0000050	0	1	1
Perfluorooctane Sulfonate (PFOS)	0.0006	<0.000010	0	1	1
Perfluorooctanoic Acid (PFOA)	0.0002	<0.000010	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. As a result, 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	0.1	<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
Malathion	0.19	<0.00010	0	1	1
MCPA	0.10	<0.00010	0	1	1
Pentachlorophenol	0.06	<0.00050	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 that are 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 mad-made sources, and from natural sources such as weathering of rocks that contain radioactive substances. 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 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	<0.19	0	1	1
Gross Beta	1.0	0.17	0	1	1
Cesium-137	10.0	<0.09	0	1	1
Iodine-131	6.0	<0.4	0	1	1
Lead-210	0.2	<0.02	0	1	1
Potassium-40	None applied	12	0	1	1
Radium-226	0.5	<0.005	0	1	1
Strontium-90	5.0	<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 that is 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 because routine analytical methods that are 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 Ultraviolet treatment, as a multi-barrier approach to ensure a 4-log inactivation of *Giardia* and *Cryptosporidium.* Raw water sampling showed a return to typical values after a spike noted in late 2020.

Table 16: Protozoa Sampling

Parameter	Sample Results (Samples are from RAW un-treated water)	# Samples Exceeding Limits	# Samples Required	# Samples Submitted
Giardia	10.5 cysts/100L	n/a	4	4
Cryptosporidium	0.0 oocysts/100L	n/a	4	4

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