



Sampling-Protocol and Procedure Water and Wastewater

Operator Workshop

September 2023

5 Ws and H-Water

- WHO
- WHAT
- WHERE
- WHEN
- WHY
- **HOW**

Who

- Operators-primary samplers and responsible for compliance sampling.
- Engineers-may sample in support of projects. This sampling should be coordinated with the system operators.
- Consultants-any sampling by consultants should be coordinated with the operators.
- Regulators-may sample as part of inspections or as random QA/QC.
- Public Health Officials-may sample in response to public health concerns or in coordination with adverse responses.

Who-Cont'd

- NOBODY SHOULD UNDERTAKE ANY WORKS ON AFNWA PWS SYSTEMS WITHOUT FULL NOTIFICATION AND APPROVAL OF THE SYSTEMS' OPERATORS/OWNERS



What

- Canadian Guidelines for Drinking Water Quality (CGDWQ).
- Microbiological Parameters, Chemical and Physical Parameters and Radiological Parameters
- E.Coli
 - P/A-ND
 - MAC-Absent
- Total Coliforms
 - P/A-ND
 - MAC-Absent
- Disinfectant residual
 - Mg/l
 - MAC-0.2 low and 4.0 high
- Turbidity
 - NTU
 - MAC-varies on location of measurement-1, 5
- Temperature
- pH
- Flows



What Cont'd

- Disinfection By-products (DBPs)
 - HAA, THM, Bromate, Chlorate and NDMA
 - Mg/l
 - THM and HAA MAC based on LRAA.
 - THM-0.1mg/l
 - HAA-0.08mg/l-ALARA
- Manganese
 - Mg/l
 - MAC-0.12 AO_≤0.02
- Lead & Copper
 - Mg/l
 - Lead MAC-0.005 ALARA
 - Copper MAC-2



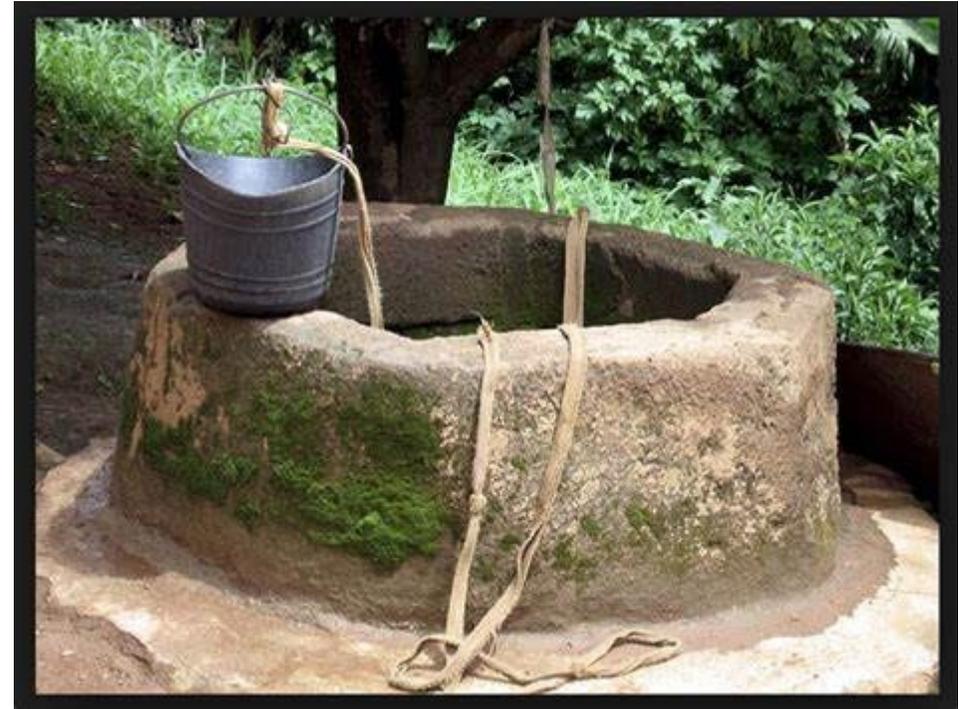
What Cont'd

- Microscopic Particulate Analysis (MPA)
 - Microns
- Chemical and Physical Parameters outlined in GCDWQ
- All parameters found in the GCDWQ
- Cyanotoxins
 - Ug/l



Where

- Raw Water
 - Turbidity and Manganese
 - Algal blooms
 - Flows
- Treatment System
 - Flows and Flow Rate
 - pH
 - Temperature
 - Turbidity
 - Residuals
 - IT and CT



When

- Sample collection requirements vary by system size, raw water source, population served
- Typically:
 - Continuously
 - Weekly
 - Quarterly
 - Annually
 - Biennially
 - Quinquennially
 - Seasonally
 - Ad-hoc

When cont'd

Continuously

- Flows
- Residual
- pH
- Temperature
- Turbidity
- IT
- CT-calculated



When cont'd

Weekly

- E. Coli
- Total Coliforms
- Disinfection residual
- Turbidity
- Weekly samples collected on Monday

Quarterly

- DBPs
 - THM, HAA, NDMA (chloramines)

|  WATER SAMPLING CALENDAR PAQTNKEK 2023 | | | | | | |
|--|---------------|---------|-----------|----------|--------|----------|
| KISIKWEKEWIKU'S / AUGUST | | | | | | |
| SUNDAY | MONDAY | TUESDAY | WEDNESDAY | THURSDAY | FRIDAY | SATURDAY |
| 30 | 31 | 1 | 2 | 3 | 4 | 5 |
| | | | | | | |
| 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| | CIVIC HOLIDAY | | | | | |
| 13 | 14 | 15 | 16 | 17 | 18 | 19 |
| | | | | | | |
| 20 | 21 | 22 | 23 | 24 | 25 | 26 |
| | | | | | | |
| 27 | 28 | 29 | 30 | 31 | 1 | 2 |
| | | | | | | |
| 3 | 4 | | | | | |
| | | | | | | |

| DAILY | | | |
|---------------|------------------|---------------|---------|
| What | Where | How | SOP |
| Flou | Plant Inlet | SCADA | - |
| Turbidity | Source | SCADA or Grab | SOP-P-2 |
| Free Chlorine | Chlorine Contact | SCADA or Grab | SOP-P-1 |
| Temperature | Chlorine Contact | SCADA or Grab | SOP-P-3 |
| pH | Chlorine Contact | SCADA or Grab | SOP-P-3 |
| Free Chlorine | Storage Outlet | SCADA or Grab | SOP-P-1 |

| WEEKLY | | | |
|-----------------|---------------------|------|---------|
| What | Where | How | SOP |
| Turbidity | Distribution System | Grab | SOP-S-2 |
| Free Chlorine | Distribution System | Grab | SOP-S-2 |
| Total Coliforms | Distribution System | Grab | SOP-S-2 |
| E. Coli | Distribution System | Grab | SOP-S-2 |

| QUARTERLY | | | |
|---------------|---------------------|------|---------|
| What | Where | How | SOP |
| Free Chlorine | Distribution System | Grab | SOP-S-2 |
| Alkalinity | Distribution System | Grab | SOP-S-3 |
| Conductivity | Distribution System | Grab | SOP-S-3 |
| Temperature | Distribution System | Grab | SOP-S-2 |
| pH | Distribution System | Grab | SOP-S-2 |
| Manganese | Storage Outlet | Grab | SOP-S-7 |
| Manganese | Distribution System | Grab | SOP-S-3 |
| THM | Distribution System | Grab | SOP-S-3 |
| HAA | Distribution System | Grab | SOP-S-3 |
| Chlorate | Storage Outlet | Grab | SOP-S-6 |
| Bromate | Storage Outlet | Grab | SOP-S-6 |

| SPECIAL SAMPLING EVENT | | | |
|------------------------|---------------------|------|-----|
| What | Where | How | SOP |
| Lead & Copper | Distribution System | Grab | |

When cont'd

- Manganese-surface water systems
- Corrosivity
 - Conductivity
 - pH
 - Alkalinity
 - Residual
- Bromate and Chlorate
 - If storing sodium hypochlorite for more than three months
- Quarterly samples collected the first month of each quarter-January, April, July, October

When cont'd

Biannually

- Manganese-ground water systems in spring and fall

Annually

- Chemical and physical parameters in the GCDWQ-Raw and Treated
- Alkalinity, Colour, pH, Aluminum, Conductivity, Potassium, Ammonia, Copper, Selenium, Antimony, Fluoride, Sodium, Arsenic, Hardness, Strontium, Barium, Iron, Sulphate, Boron, Lead, Total Dissolved Solids, Cadmium, Magnesium, Total Organic Carbon, Calcium, Manganese, Turbidity, Chloride, Nitrate, Uranium, Chromium, Nitrite, Zinc



When cont'd

Seasonally

- Lead-annually between May and September
- Cyanobacteria
 - observations for bloom between May and October
 - Cyanobacterial toxins - Total Microcystins during a bloom

Quinquennial

- GCDWQ-Full Suite
- Cyanobacterial toxins and total microcystins in surface water systems in the raw and treated water

How

- The meat and potatoes of it all. Specific bottles, preservatives/reactants and collection requirements.



Microbiological

Bottle Types/Preservatives:

- 500ml acid-washed PE with sodium thiosulphate

Sample Collection:

- Follow SOP

Sample Storage:

Samples should be kept cold (less than 10°C – ideally at 4°C) during collection/storage and while shipping to the laboratory. Do not allow samples to freeze.

How cont'd

Holding time:

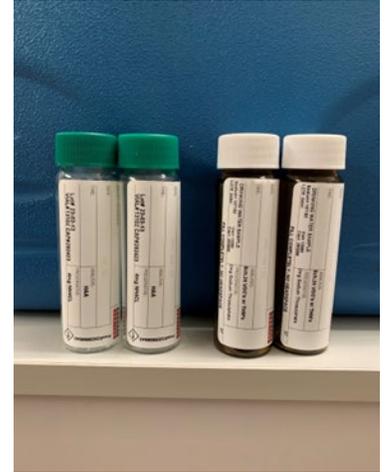
24 hours from time of sampling until analysis at the laboratory.

DBPs

Bottle Types/Preservatives:

HAA: 2 x 40ml clear glass vials (green tops) with 4mg Ammonia Chloride (NH_4Cl) per vial. Vials come pre-charged with the preservative.

THM: 2 x 40ml amber glass vials with 2mg Sodium Thiosulphate per vial. Vials come pre-charged with the preservative.



How cont'd-DBPs

Sample Collection:

Sample bottles for both HAAs and THMs should be filled to the top with no headspace or air bubbles taking care not to overflow and lose the pre-charged preservatives out of the bottles.

Sample Storage:

Samples should be kept cold (less than 10°C – ideally at 4°C) during collection/storage and while shipping to the laboratory. Do not allow samples to freeze.

Holding time:

14 days for both HAAs and THMs from time of sampling until analysis at the laboratory.

Bottles with preservatives, reactants, etc must not be overfilled and provide air space where required. Always fill to the fill-line.

How cont'd

Annual Paired-Raw and Treated

Bottle Types/Preservatives:

Total Dissolved Solids: 1 x 500ml plastic bottle. There is no preservative required.

Alkalinity, Chloride, Colour, Conductivity, Fluoride, Nitrate/Nitrite, pH, Sulphate, and Turbidity: 1 x 250ml plastic bottle for all listed tests. There is no preservative required.

Metal Scan & Hardness: 1 x 120ml plastic red top bottle pre-charged with 2ml 18% Nitric Acid (HNO₃)

Total Organic Carbon (TOC): 1 x 120ml plastic yellow top bottle pre-charged with 0.5ml 50% Sulphuric Acid (H₂SO₄)

Ammonia: 1 x 40ml clear glass vial pre-charged with 0.17ml 50% Sulphuric Acid (H₂SO₄)

How cont'd-Annual Paired

Sample Collection:

Fill the bottles to the fill line. If no fill line is present, fill to the top without any headspace. Do not overflow and lose the pre-charged preservatives out of the applicable bottles.

Sample Storage:

Samples should be kept cold (less than 10°C – ideally at 4°C) during collection/storage and while shipping to the laboratory. Do not allow samples to freeze.

Holding time:

The Annual Paired sampling package has a range of holding times from asap to 6 months. With all analysis, Bureau Veritas recommends that samples are collected and shipped to the laboratory within 24 hours of collection if possible.

How cont'd

Lead

Fill the bottles to the fill line. If no fill line is present, fill to the top without any headspace. Do not overflow and lose the pre-charged preservatives out of the applicable bottles.

Bottle Types/Preservatives:

Wide mouth 950ml bottles. Acid-washed and certified metal-free.

Sample Collection:

RDT, 30MS and Sequential

Sample Storage:

Samples should be kept cold (less than 10°C – ideally at 4°C) during collection/storage and while shipping to the laboratory. Do not allow samples to freeze.

Holding time:

The samples should be kept cool and must be held for a minimum of 16 hours before analysis.



How cont'd

Chain of Custody (CoC) cont'd

- Required service levels
- SPL identifiers-WaterTrax
- Records sample information
- Records sample receiver and temperature of samples
- Serves as a record of the sampling activity and its acceptable condition upon receipt



How cont'd

Field Instruments

Colourimeter

- Calibration and use
- Follow SOP

Turbidimeter

- Validation and use
- Follow SOP



Wastewater

Sampling Protocols



WHO

- Operators
- Regulatory Professionals
- Engineers and Consultants
- Public Health Officials-Covid 19



- **NOBODY SHOULD UNDERTAKE ANY WORKS ON AFNWA WW SYSTEMS WITHOUT FULL NOTIFICATION AND APPROVAL OF THE SYSTEMS' OPERATORS/OWNERS**

WHAT

- Carbonaceous Biochemical Oxygen Demand (CBOD)
 - 25mg/l-WSER requirement
- Total Suspended Solids
 - 25mg/l-WSER requirement
- Total Chlorine Residual
 - 0.02 mg/l-where chlorine or one of its compounds is used-WSER requirement
- Un-ionized Ammonia (UIA)
 - 1.25mg/l-no longer a required analyte under WSER
- Acute Lethality Testing
 - >2500 ≤50000-quarterly
 - >50000-monthly
 - Not applicable to AFNWA systems
- Flows
 - Must be metered-m³
- Total days of effluent discharge in recording period
- Operational Optimizations

WHAT

Environmental Risk Assessments (ERAs)

- Assessments to document risks presented by the system to the receiving environment.
- Assess and quantify the acceptable discharge into the receiving environment without harm

Environmental Discharge Objectives (EDOs)

- Quantified values mentioned above
- Specific to each system

Environmental Discharge Objectives (EDOs)

- Total Phosphorous (TP)
- E. Coli
- Total Nitrogen
- Nitrogen (Ammonia Nitrogen) as N
- pH
- UIA

Where

Wastewater should be sampled at the point where the treatment process ends and the final effluent is discharged

Assures accurate presentation of impacts to the receiving environment

Various points in the treatment train for operational assessments.



When

Sampling frequencies are based upon several factors

- Average Daily Volumes of effluent (ADV)
- Hydraulic Retention Time (HRT)

Examples:

HRT < 5 days & $ADV \leq 2500 \text{m}^3$ = monthly grab or composite

HRT > 5 days & $ADV \leq 2500 \text{m}^3$ = quarterly grab

HRT > 5 days & $ADV > 2500 \text{m}^3$ & $\leq 17500 \text{m}^3$ = bi-weekly composite

All AFNWA systems are $\leq 2500 \text{m}^3$ (pending final determinations)

Upon request by regulator.

Why

Environmental Protection

- Wastewater effluent can be very harmful to the receiving environment
- WSER minimum
- CCME and Canada-wide Strategy

Public Health

- Errant discharges can negatively impact recreational and agricultural areas
- Risks to surrounding wells
- Commercial activities

Regulatory Compliance

- Documents and assures the above two goals are achieved.

How

Annual Sampling Plans

- Monthly or quarterly sampling of WSER and EDOs

Capacity Building

Continuous Improvement/Systems Optimizations



**Thank you
Questions?**

