Environment Canada Environnement Canada

QUALITY ASSURANCE (QA) AND QUALITY CONTROL (QC) PROGRAM

— Eureka High Arctic Weather Station —

In support of the
Nunavut Water Board License
No. 8BC-EUR2131

Prepared by Environment and Climate Change Canada
Corporate Services and Finance Branch (CSFB)

September 2021

Canada

Control Page

On receipt of revisions and/or amendments, the Corporate Services and Finance Branch (CSFB) shall complete this control page to ensure that the Quality Assurance (QA) and Quality Control (QC) Program at Eureka High Arctic Weather Station (HAWS) is always current and consistently reflects the operations and activities taking place on site.

Version	Date in Force	Expiry Date	Description / Purpose
1	November. 23rd, 2007	November 22nd , 2008	Original Program
2	October 10, 2021	October 9, 2022	Update

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Acronyms

BOD	Biochemical Oxygen Demand
BTEX	Benzene, Toluene, Ethylbenzene and Xylene
CFSB	Corporate Services and Finance Branch
CIRNAC	Crown-Indigenous Relations and Northern Affairs Canada
CoC	Chain of Custody
ECCC	Environment and Climate Change Canada
GPS	Global Positioning System
HAWS	High Arctic Weather Station
HDPE	High Density Polyethylene
NWB	Nunavut Water Board
PPE	Personal Protective Equipment
pH	Measure of acidity and alkalinity
QA	Quality Assurance
QC	Quality Control
TKN	Total Kjeldahl Nitrogen
TSS	Total Suspended Solids
UV	Ultraviolet

1. Introduction

This document has been prepared in response to the requirements of the Nunavut Water Board License number 8BC-EUR2131, issued to Environment and Climate Change Canada (ECCC) on July 22, 2021. Specifically, this document satisfies the requirements set out in the above mentioned license, Part I, point 9, which states:

"Licensee shall submit for review of the Board, within ninety (90) days of issuance of this Licence, a revised Quality Assurance / Quality Control (QA/QC) Plan that includes field and laboratory procedures for sampling and analysis. The Plan shall include up to date sampling methods to all applicable standards, acceptable to an accredited laboratory as required by Part I, Item 8. The Plan submission shall include a cover letter from an accredited laboratory confirming acceptance of the Plan for analyses to be performed under this Licence."

The requirements of the Nunavut Water Board License number 8BC-EUR2131 specifically target ECCC's Eureka High Arctic Weather Station (HAWS) which is located on the north side of Slidre Fjord, at the north-western tip of Fosheum Peninsula on Ellesmere Island at 80^{o} 0' N and 85^{o}56' W.

Eureka HAWS is a weather monitoring facility that has been in operation since 1947. The Eureka HAWS is a centre of activity for ECCC, the Department of National Defence, Natural Resources Canada, and the Canadian Network for the Detection of Atmospheric Change. Most of the work is carried out in the short Arctic summer – June, July and August. The number of people located on-site varies between 8 and 34.

2. Program Objectives

This document will ensure that water samples collected in the field, as part of the requirements of the water licence, accurately reflect the physical and chemical nature of the water tested. The procedures described below refer to samples that are collected for:

1. Quantity assessment of raw water supply.
   a. Station Creek
   b. Blacktop Creek
   c. West Remus Creek
2. Quantity assessment of wastewater discharge.
3. Quality assessment of wastewater discharge.
4. Quality assessment of runoff from waste disposal site.
5. Quality assessment of runoff from quarry operations.
6. Quality assessment of runoff from contaminated soil stockpiles.

To ensure a common understanding of these two terms, a definition for each is provided below:

- ***Quality Assurance (QA)****:* is the system of activities designed to maintain a certain level of service or product.

- ***Quality Control (QC)***: is the system of procedures designed to maintain test sample outputs against specification.

3. Sample Handling

The following section describes the procedures for handling the samples collected at Eureka HAWS. See Appendix A for Taiga Laboratories Sampling Instructions.

3.1 Preservation

Raw and potable water testing are not required by the licence however are required for Occupational Health and Safety. Quality tests of raw and potable water are carried out on-site. See Appendix B for raw and potable water testing procedures.

The samples collected from EUR-2 Solid Waste Disposal Facility are preserved using the following methods:

Bottle	Preservative	Parameter
500 mL plastic bottle	Nitric acid	Total metals
1 L glass bottle	None	BTEX, total volatile hydrocarbons and total extractable hydrocarbons

Table 1. Methods for preserving samples collected from the solid waste disposal area.

The samples collected from EUR-3 Sewage Lagoon are preserved using the following methods: See Appendix C for Decanting Procedure.

Bottle	Preservative	Parameter
500 mL plastic bottle	None	TSS and nitrate-nitrite (as N)
250 mL plastic bottle	50 mL 20% nitric acid	Total silver
1 L plastic bottle	None	BOD
250 sterilized plastic bottle	Sodium thiosulfate	Fecal coliform
100 amber glass bottle	1 ml 1:1 sulfuric acid	Phenols
500 mL plastic bottle	2 mL 1:1 sulfuric acid	Ammonia-N, TKN, P

Table 2. Methods for preserving samples collected from the sewage lagoon discharge and mixing zone.

3.2 Sample Identification

All sample locations from Section 6.1 will be used to label and identify all sample bottles respectively.

A clear Chain of Custody (CoC) record must be generated at the time of sampling, and must be part of the final report describing the sampling and results by either ECCC personnel or by contractors. The record must contain the following information:

- Identification of sampling site – general and specific (ex: Eureka - Sewage Lagoon);
- Sample ID (ex: EUR-3);
- Date, time and time zone of Collection;
- Name and affiliation of person(s) collecting the samples;
- Size of sample container;
- Analysis required; and
- Name and signature of all individuals involved in the chain of possession.

Sample bottles must be correctly labelled and must contain the following:

- Submission Number: Month Number (ex: March = 3);
- Field Sample Number: Sample Location ID (ex: EUR-3);
- Sample Description: general and specific (ex: Eureka - Sewage Lagoon);
- Date, Time and Time Zone; and
- Sampler Name.

3.3 Transportation

Samples from all media must be stored on-site in appropriate storage containers (ex: coolers with ice packs). The samples must not be frozen unless this is identified by the laboratory that shall be carrying out the analysis.

For some analysis (i.e. bacteriological analyses), it is imperative that the samples reach a laboratory in a specified time period. The sampling must be timed to align with a plane destined to the location where the samples shall be analyzed. The samples, when shipped, must be well packed to protect them from any harm along the way, especially if glass bottles are used. Also, if required, a label must be attached to the container to indicate what is contained in the container and if any special care is required (i.e. keeping the container cool).

4. Laboratory Analyses

The following section describes the requirements relating to the laboratory analyses of the samples collected at Eureka HAWS.

4.1 Laboratory Accreditation

Analysis of all samples collected for the Eureka Haws in support of the water license must be carried out by an accredited laboratory, ideally accredited by the Canadian Association for Environmental Analytical Laboratories. The laboratory must provide a certificate of their accreditation along with a copy of the methods used to analyze the samples and a copy of their QA/QC methods that were in place when the analyses were being carried out.

4.2 Detection Limits

The laboratory must provide detection limits for all of the methods that are used for the analysis of the samples.

4.3 Laboratory Methods

As stated in section 5.1, the laboratory must provide a copy of the methods used to analyze the samples.

5. Reporting Requirements

Eureka HAWS will select two sampling locations annually and must collect duplicate samples at these sampling points. These duplicates will serve as internal/external check for Eureka HAWS and the commercial laboratory.

Each full report must consist of the following (electronic or hard copy format):

1. Objective – shall include who was doing the sampling, dates, site conditions.
2. Description of sampling – equipment and sample containers used
3. Identification of sampling point locations – GPS co-ordinates, photographs, narrative description, etc.
4. List of samples collected, method of collection, preservation and transportation methods.
5. Identification of laboratory that shall carry out the analysis of samples, letter of accreditation of the laboratory, description of methods used or clear references to already published methods that are being used for the analysis, method detection limits and full QA/QC used when analysing the samples.

All results shall be presented in a tabular format (electronic or hard copy) and shall include any special conditions that were associated with sample collection, transportation or analysis.

6. Sample Collection

The following section describes the various locations and methods used for collecting samples at Eureka HAWS.

6.1 Sample Locations

Station	Description	Parameter
EUR-1	Raw water supply prior to treatment at Station Creek	Active (Volume)
EUR-2	Runoff from the Solid Waste Disposal Facilities	Active (Quality)
EUR-3	Effluent discharge from the Sewage Lagoon to the ocean	Active (Quality, Volume)
	Quantity in cubic meters of sludge removed from the Sewage Lagoon	
EUR-4	Effluent Discharge from the Landfarm	Active (Quality)
EUR-5	Runoff from the quarry development at the exit point of ditches designed to collect and hold runoff water prior to release	Active (Quality)
EUR-6	Effluent Discharge from the Temporary Contaminated Soil Storage	Active (Quality)
EUR-7	Raw water supply at West Remus Creek	Active (Volume)
EUR-8	Raw water supply at Blacktop Creek	Active (Volume)

6.1.1 EUR-1 Raw water supply prior to treatment at Station Creek

Located at the south west side of the fresh water lagoon near the Station Creek Bridge.

6.1.2 EUR-2 Runoff from the Solid Waste Disposal Facilities

Located near the east end of the runway, the solid waste disposal facility faces south into a ravine. There is a natural swale that runoff collects into where water sample is taken. It is not always possible to collect the samples and transport them to the lab within 24 hours.

6.1.3 EUR-3 Discharge from the Sewage Lagoon

Located at the south west end of the Sewage Lagoon near the Pump Shack. Two activities occur here; first to collect quality samples and second to measure quantity discharged.

6.1.4 EUR-4 Effluent discharge from the Landfarm

Located at the former tank farm just north west of the main complex. Runoff is collected from the natural drainage swales. It is not always possible to collect the samples and transport them to the lab within 24 hours.

6.1.5 EUR-5 Runoff from quarry operations

Originally located at Blacktop Creek quarry until the usable material was exhausted and then relocated to West Remus Creek quarry. Collected from drainage swales resulting from quarry operations. It is not always possible to collect the samples and transport them to the lab within 24 hours.

6.1.6 EUR-6 Effluent discharge from Contaminated Soil Storage

Located east of the barrel crushing site and south of the runway. Temporary storage area of contaminated soil excavated during the north apron runway upgrade and reconstruction. It is not always possible to collect the samples and transport them to the lab within 24 hours.

6.1.7 EUR-7 Raw water supply at West Remus Creek

Located at the West Remus Creek quarry where water is extracted for carwash or dust control purposes.

6.1.8 EUR-8 Raw water supply at Blacktop Creek

Located at the Blacktop Creek quarry where water is extracted for carwash or dust control purposes.

Eureka Site Plan: Water Sample Locations

Eureka Site Plan: Main Complex Area

Eureka Site Plan: Airport

Eureka Site Plan: Black Top Creek Quarry

Eureka Site Plan: West Remus Creek Quarry

6.2 Sampling Equipment

- Safety footwear with skid proof soles or rubber boots/waders
- Protective gloves; chemical resistant
- Safety glasses/face shield
- Respirator/face mask (if necessary)
- Coveralls or apron
- High visibility vest
- Transport Canada approved personal flotation device
- Sample bottles
- Cooler full of ice
- Chain of Custody form
- Telescopic pole with collection container attached
- Sample transfer funnel
- Paper towel

6.3 Sampling Methods

All quantity samples are measured using inline mechanical flow meters that account for pump efficiency.

All quality samples are grab samples. A sample will be collected in its dedicated container and transferred into the sample bottles for transport.

6.3.1 EUR-1 Raw water supply prior to treatment at Station Creek

At location EUR-1, submersible water pumps with a 50mm NPT connection are positioned into Station Creek for water collection. These pumps are encased in a fine screen mesh to preserve aquatic life from being devastated by the pumps impeller. The submersible pumps have rigid 50mm PVC piping attached that matches the head output of the pumps. 50mm lay flat hose is connected to the PVC via cam lock connections which are then connected to the mechanical flow meters input. The output of the mechanical meters is a 1m length of 50mm PVC.

1. Prior to operation the mechanical meters reading is recorded along with the date and time.
2. At the end of operation a final reading is recorded along with the date and time.
3. If the run time spanned overnight then the daily amount recorded is extrapolated by:
   a. determining the total quantity pumped
   b. determining the total run time
   c. m^3/hr pumped = total quantity / total run time
   d. Q = m^3/hr pumped x hours remaining that day

6.3.2 EUR-2 Runoff from the Solid Waste Disposal Facilities

1. The timing is during periods of observed flow; this means during thaw months when it is raining. During or shortly after periods of rain travel to the solid waste disposal site and go to the bottom of the valley. There are some natural drainage swales that should have the observable flow desired.
2. Donne PPE.
3. Collect runoff into a container and transfer it into the sample bottles.
    a. Follow Appendix A Taiga Laboratory Sampling Instructions for details about specific bottles.
4. Sample bottles need to be labeled with date, time, location and person.
5. Store the samples just above freezing temperatures until transportation to the lab can be arranged.

6.3.3 EUR-3 Discharge from the Sewage Lagoon

This sample should be collected as the monthly during periods of ice free conditions within the lagoon. Time the collection of the sample to correspond with the arrival of the monthly resupply airplane. When timed correctly the samples should make it to the lab within about 18 hours. Samples fail if the holding time exceeds 24 hours.

1. When the monthly produce charter has radioed into the station to say they are about 20mins out, travel to the sewage lagoon.
2. Donne PPE.
3. Use the telescopic pole with the collection container fixed to the end and dip the collection container into the sewage lagoon to collect a sample.
4. Transfer the sample from the collection container into a sample bottle.
    a. Follow Appendix A Taiga Laboratory Sampling Instructions for details about specific bottles.
5. Sample bottles need to be labeled with date, time, location and person.
6. Place the bottles into a cooler full of ice.
7. Label the cooler for transportation.
8. Complete a CoC form to transfer custody to the airplane pilot.

6.3.4 EUR-4 Effluent discharge from the Landfarm

The timing is during periods of observed flow; this means during thaw months when it is raining.

1. During or shortly after periods of rain travel to the landfarm and search for standing water or natural drainage swales on the embankment facing west.
2. Donne PPE.
3. Collect runoff into a collection container and transfer the runoff into the sample bottles.
    a. Follow Appendix A Taiga Laboratory Sampling Instructions for details about specific bottles.
4. Sample bottles need to be labeled with date, time, location and person.
5. Store the samples just above freezing temperatures until transportation to the lab can be arranged.

6.3.5 EUR-5 Runoff from quarry operations

The timing is during periods of observed flow; this means during thaw months when it is raining.

1. During or shortly after periods of rain travel to the West Remus Quarry and search for standing water or natural drainage swales on the landscape.
2. Donne PPE.
3. Collect runoff into a collection container and transfer the runoff into the sample bottles.
    a. Follow Appendix A Taiga Laboratory Sampling Instructions for details about specific bottles.
4. Sample bottles need to be labeled with date, time, location and person.
5. Store the samples just above freezing temperatures until transportation to the lab can be arranged.

6.3.6 EUR-6 Effluent discharge from Contaminated Soil Storage

The timing is during periods of observed flow; this means during thaw months when it is raining.

1. During or shortly after periods of rain travel to the Contaminated Soil Storage location and search for standing water or natural drainage swales down hill of the pile.
2. Donne PPE.
3. Collect runoff into a collection container and transfer the runoff into the sample bottles.
    a. Follow Appendix A Taiga Laboratory Sampling Instructions for details about specific bottles.
4. Sample bottles need to be labeled with date, time, location and person.
5. Store the samples just above freezing temperatures until transportation to the lab can be arranged.

6.3.7 EUR-7 Raw water supply at West Remus Creek

General Contractor Nuna East Ltd might collect water from West Remus Creek for carwash or dust control purposes. Nuna has been instructed to use a meter on their water pumps and report all numbers to ECCC to include in the annual report.

6.3.8 EUR-8 Raw water supply at Blacktop Creek

General Contractor Nuna East Ltd might collect water from Blacktop Creek for carwash or dust control purposes. Nuna has been instructed to use a meter on their water pumps and report all numbers to ECCC to include in the annual report.

7. References

Nunavut Water Board Water Licence 8BC-EUR2131 July 22, 2021

Environment and Climate Change Canada's Task Hazard Analysis #028 Sewage Handling and Sampling 2016-04-20

Environment and Climate Change Canada's Safe Work Practice #028 Sewage Handling and Sampling 2016-04-20

Environment and Climate Change Canada's Wastewater Systems Effluent Regulations: Sample Guidance Toolkit 2021

Taiga Environmental Laboratory Water Sampling Instructions February 18, 2019

Environment and Climate Change Canada's Enforcement Officer's Field Sampling Manual 2020

Environment and Climate Change Canada's Water Quality Divisions Standard Operating Procedure Freshwater Sampling Red River at Emmerson December 2014

Department of Indian and Northern Affairs Canada, Water Resources Division and the Northwest Territories Water Board (1996). *Quality assurance (QA) and Quality control (QC) Guidelines for use by class "B" licensees in collecting representative water samples in the field and for submission of a QA/QC plan*.

Health Canada (2009). Guidelines for Canadian drinking water quality: Guideline technical document-Chlorine. Water Quality and Health Bureau, Healthy Environments and Consumer Safety Branch, Health Canada, Ottawa, Ontario

HACH Colorimeters DR300 Resource Library (hach.com) Documents 316.53.01486 and 316.53.01487

Appendix A

Taiga Laboratory Sampling Instructions

Taiga Environmental Laboratory
4601 52nd Avenue – Yellowknife, NT X1A 2L9
Phone: (867) 767-9235 Fax: (867) 920-8740 Email: taiga@gov.nt.ca

Water Sampling Instructions

Step One: Prior to sampling, ensure you have obtained all the sampling equipment you require, such as the proper bottles, filtration devices, *etc.* Refer to Taiga's Field Sheet and Bottle &/or Preservation Order Form. If there are any questions or concerns, do not hesitate to contact the laboratory. Please have your water license (if applicable) available before contacting the laboratory to ensure proper bottles are ordered. **Note: you may need more than one bottle per sampling site.**

Step Two: Check your local departure flight schedule to Yellowknife for the day you plan to take your samples. Samples should be shipped to the Laboratory **as soon as possible** after collection. Time your sampling so that the samples can be shipped out by plane as soon as possible.

Step Three: Follow the sampling instructions on the back of this sheet for each bottle type. Package bottles in a cooler and send to the laboratory. If you require microbiological tests, such as Total Coliforms, E. coli., Fecal Coliforms, BOD, *etc.*, please contact the laboratory with the collection date and time, the Airline name, the waybill number and the expected time of arrival.

Safety Issues: Wear appropriate gloves when collecting any sample to avoid contamination and possible exposure to unhealthy substances. The sample preservatives provided by the Laboratory are corrosive and will cause a burning sensation on the skin. If you should spill any on your skin or clothes, rinse the area **immediately** with lots of cool water. Call a doctor should the burning sensation continue.

Taiga Environmental Laboratory
4601 52nd Avenue – Yellowknife, NT X1A 2L9
Phone: (867) 767-9235 Fax: (867) 920-8740 Email: taiga@gov.nt.ca

Water Sampling Instructions

Parameter Group	Marking	Preservative	Instructions
Routine	GREEN	Keep cool at 4°C	1. Rinse bottle three (3) times with sample 2. Fill to top and cap bottle.
Nutrients	BLACK	Keep cool at 4°C	
Biochemical Oxygen Demand (BOD)/Carbonaceous BOD (CBOD)	PURPLE	**Keep cool at 4°C**	1. Rinse bottle three (3) times with sample 2. Fill to top and cap bottle. 3. Sample must be sent to laboratory within 24 hours
Microbiological	STERILE	Sodium thiosulphate and Keep cool at 4°C	1. **DO NOT RINSE BOTTLE** 2. Fill to top and cap bottle. 3. Sample must be sent to laboratory within 24 hours
Total Metals	RED	5mL of 1:3 nitric acid in RED-dot vials	1. Rinse bottle three (3) times with sample 2. Fill to near the top. 3. Add contents of preservative vial 4. Cap bottle and mix.
Dissolved Metals	RED	5mL of 1:3 nitric acid in RED-dot vials	1. **Filter Sample with 0.45 µm Cellulose Acetate filter** 2. Rinse bottle three (3) times with **filtrate** 3. Fill to near the top. 4. Add contents of preservative vial 5. Cap bottle and mix.
Hexane Extractable Material (HEM) (also known as Oil and Grease)	YELLOW	4mL 1:1 sulphuric acid in YELLOW-dot vial	1. **DO NOT RINSE BOTTLE** 2. Fill to shoulder of bottle. 3. Add contents of preservative vial 4. Cap bottle and mix
BTEX, THM & Purgeable Hydrocarbons	40 mL CLEAR GLASS W/ WHITE LID	Keep cool at 4°C	1. **DO NOT RINSE BOTTLE** 2. Fill bottle completely leaving **NO** air bubbles
Extractable Hydrocarbons	1 L AMBER GLASS W/ WHITE LID	Keep cool at 4°C	1. **DO NOT RINSE BOTTLE** 2. Fill to top and cap bottle.
Cyanide	BLUE	1mL of 6N sodium hydroxide	1. Rinse bottle three (3) times with sample 2. Fill to near the top. 3. Add contents of preservative vial 4. Cap bottle and mix.
Thiocyanate	ORANGE	2ml of 25% sulphuric acid or keep cool at 4°C	
Phenol	YELLOW with P	2mL of 20% sulphuric acid	
Sulphide	ORANGE with S	2mL of 25% zinc acetate	
Radionuclide	No Markings	10mL of 17.5% nitric acid per 1L sample	
Chlorophyll A	1L PLASTIC BOTTLE	Keep cool at 4°C and keep in dark	1. Rinse bottle three (3) times with sample 2. Fill to top and cap bottle. 3. Sample must be sent to laboratory within 24 hours

Appendix B

Eureka HAWS Potable Water Testing

MONTHLY WATER TESTING

Sample Locations: **Weather Office Water Tap**
Weather Office Reverse Osmosis Tap
Kitchen Tap
Tank Room Before Filtration – around back of first tank

All Water Testing supplies are kept in SAO office.

Regularly check expiry dates of all products, order new supplies as required. Further water testing and ordering information can be found in filing cabinet.

* Pre-heat incubator for the Colilert Test as it takes a while. First remove Quanti-Tray Comparator and thermometer, ensure it's plugged in, then turn on power bar. Insert thermometer into hole on top of incubator. Dial should be set to around four, as marked on front. Allow it to warm up to 35°C ±0.5°C.

CHLORINE TEST (FREE & TOTAL)

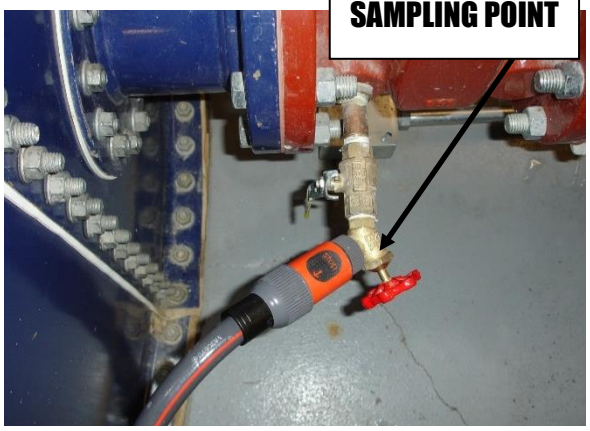
You Will Need: HACH Chlorine Test Kit
Distilled water
Kimwipes

Procedure Notes:

Inside the Test Kit are complete instructions in the **Pocket Colorimeter Instruction Manual pages 1-16 to 1-19**. The kit also contains one cell marked for use as the 'Sample', one for 'Total' and one for 'Free'.

Between samples thoroughly cleanse the inside of sample bottles and lids with distilled water. Be sure to zero the Colorimeter before the next test. Also wipe water and fingerprints from the outside of bottles before placing into cell compartment.

Allowable levels < 0.2 mg/L



pH TEST

You Will Need: HACH Pocket Pal pH Tester (in Test Kit)
100mL Nalgene beaker
Distilled water
Buffer Solution

Procedure Notes:

Press On/Off switch at top of pH Tester to turn it on, remove protective cap from bottom.

Calibrate: fill beaker with 60-80mL of pH 7.0 Buffer Solution. Immerse tester in solution, gently stir for several seconds. When the digital display stabilizes, read the pH value (should be 7.0).

Rinse the bottom of tester with distilled water. Obtain pH values for the four sample points in the same manner as above.

Periodically adjust Tester calibration. Refer to card in the HACH Test Kit for maintenance and other information. If Buffer Solution was frozen during shipping just shake to ensure it is mixed.

Allowable levels 6.5 to 8.5

COLILERT TEST

Colilert simultaneously detects coliforms and E.coli in water. When total coliforms metabolize Colilert's nutrient indicator, the sample turns yellow. When E.coli metabolize Colilert's nutrient indicator, the sample fluoresces.

You will Need: Four sterile IDEXX 120mL vessels with Sodium Thiosulphate
Four Colilert Snap Packs containing white powder
Four Quanti-Trays

Procedure:

Switch the IDEXX Sealer on to warm it up. Power switch is located on the back. The amber light on front will illuminate. Once both the amber and green lights are on the Sealer is ready to go. Ensure the Input Shelf is attached to the front, and pull unit away from the wall to allow room for the sealed tray to exit.

Label vessels and Quanti-Trays for each of the four locations.

At each sample point allow water to run 5 minutes, fill vessel to 100mL line – do not touch faucet to bottle.

Add contents of one Snap Pack to each sample. Tightly secure lid and shake sample until powder is dissolved.

Pour entire contents of sample bottles into Quanti-Trays. To open Quant-Tray: Hold with bubble packs facing palm, squeeze the edges so the backing and tray separates.

As you fill each Quanti-Tray, seal it in the IDEXX Quanti-Tray Sealer. Place a Quanti-Tray into the Rubber Insert. Place Insert (groove end first) onto the Input Shelf. Slide into Sealer until the motor grabs and draws it in.

Should you need to reverse the movement of the tray, hit the Reverse button (this should not be done unless necessary).

In y15 seconds the Tray and Insert should come out the back of the Sealer, and the Quanti-Tray will be sealed.

Once all four Quanti-Trays have been sealed properly, turn off sealer. Place the stacked trays into the incubator once the temperature has stabilized at 35°C. Incubate for 24 hours.

After 24 hours...

Check samples against the Quanti-Tray Comparator using the Results Interpretation table (below). Count the number of positive wells and refer to the MPN table provided.

Look for fluorescence with a 6-watt, 365 nm, UV light (beside SAO printer). Hold light within 5 inches of the sample, in a dark environment.

Results Interpretation Table:

Appearance	Result
Less yellow than the comparator	Negative for total coliforms and E.coli
Yellow ≥ the comparator	Positive for total coliforms
Yellow and fluorescence ≥ the comparator	Positive for E.coli

Chlorine, Free, Low Range

DOC316.53.01486

USEPA DPD Method[1] **Method 8021**

0.02 to 2.0 mg/L Cl_2 **SwifTest™ Dispenser**

Scope and application: For testing free chlorine (hypochlorous acid and hypochlorite ion) in water and treated waters. USEPA accepted for reporting for drinking water analyses.[2] This product has not been evaluated to test for chlorine and chloramines in medical applications in the United States.

[1] USEPA accepted for reporting wastewater and drinking water analyses.
[2] Procedure is equivalent to USEPA method 330.5 for wastewater and Standard Method 4500-Cl G for drinking water.

Test preparation

Before starting

Analyze the samples immediately. The samples cannot be preserved for later analysis.
Always do tests in sample cells. Do not put the instrument in the sample or pour the sample into the cell holder.
Make sure that the sample cells are clean and there are no scratches where the light passes through them.
Rinse the sample cell and cap with the sample three times before the sample cell is filled.
Make sure that there are no fingerprints or liquid on the external surface of the sample cells. Wipe with a lint-free cloth before measurement.
Cold waters can cause condensation on the sample cell or bubbles in the sample cell during color development. Examine the sample cell for condensation or bubbles. Remove condensation with a lint-free cloth. Invert the sample cell to remove bubbles.
Install the instrument cap over the cell holder before ZERO or READ is pushed.
Do not use the same sample cells for free and total chlorine. If trace iodide from the total chlorine reagent is carried over into the free chlorine determination, monochloramine will interfere. It is best to use separate, dedicated sample cells for free and total chlorine measurements.
If the test result is over-range, or if the sample temporarily turns yellow after the reagent addition, dilute the sample with a known volume of high quality, chlorine demand-free water and do the test again. Some loss of chlorine may occur due to the dilution. Multiply the result by the dilution factor. Additional methods are available to measure chlorine without dilution.
After the test, immediately empty and rinse the sample cell. Rinse the sample cell and cap three times with deionized water.
For the best results, measure the reagent blank value for each new lot of reagent. Replace the sample with deionized water in the test procedure to determine the reagent blank value. Subtract the reagent blank value from the sample results.
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.
Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

Items to collect

Description	Quantity
SwifTest™ DPD Free Chlorine Reagent	1 dispensation
Sample cells, 25-mm (10 mL)	2

Refer to Consumables and replacement items on page 5 for order information.

Sample collection

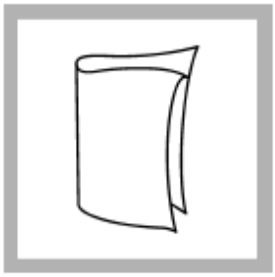
- Analyze the samples immediately. The samples cannot be preserved for later analysis.
- Chlorine is a strong oxidizing agent and is unstable in natural waters. Chlorine reacts quickly with various inorganic compounds and more slowly with organic compounds. Many factors, including reactant concentrations, sunlight, pH, temperature and salinity influence the decomposition of chlorine in water.
- Collect samples in clean glass bottles. Do not use plastic containers because these can have a large chlorine demand.
- Pretreat glass sample containers to remove chlorine demand. Soak the containers in a weak bleach solution (1 mL commercial bleach to 1 liter of deionized water) for at least 1 hour. Rinse fully with deionized or distilled water. If sample containers are rinsed fully with deionized or distilled water after use, only occasional pretreatment is necessary.
- Make sure to get a representative sample. If the sample is taken from a spigot or faucet, let the water flow for at least 5 minutes. Let the container overflow with the sample several times and then put the cap on the sample container so that there is no headspace (air) above the sample.

SwifTest™ dispenser procedure

1. Set the instrument to low range (LR).

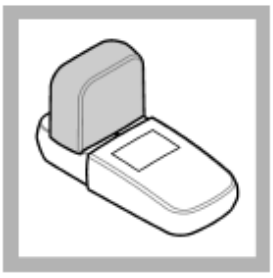
For DR300, push the up arrow button. For PCII, push the menu button, checkmark button, then the menu button again.

2. Prepare the blank: Rinse a sample cell and cap three times with sample. Fill the sample cell to the 10-mL mark with sample. Close the sample cell.



3. Clean the blank sample cell.

4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.

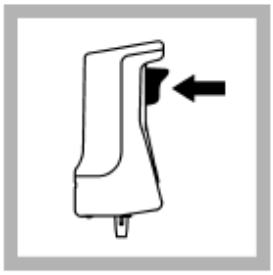


5. Install the instrument cap over the cell holder.

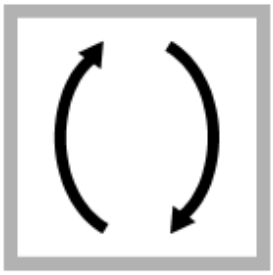
6. Push **ZERO**. The display shows "0.00".

7. Remove the sample cell from the cell holder.

8. Prepare the sample: Rinse a second sample cell and cap three times with sample. Fill the sample cell to the 10-mL mark with sample.

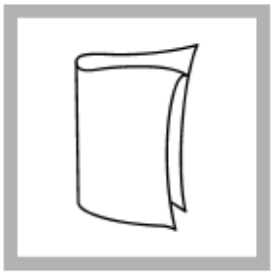


9. Add one dispensation of DPD Free Chlorine Reagent to the second sample cell.



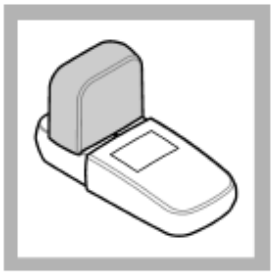
10. Close the sample cell. Invert the sample cell for about **20 seconds** to dissolve the reagent. Undissolved power will not affect accuracy.

A pink color will show if chlorine is in the sample.



11. Clean the prepared sample cell.

12. Within 1 minute of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.



13. Install the instrument cap over the cell holder.

14. Push **READ**. Results show in mg/L Cl_2.

Interferences

Interfering substance	Interference level
Acidity	More than 150 mg/L $CaCO_3$. The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sodium Hydroxide. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Alkalinity	More than 250 mg/L $CaCO_3$. The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sulfuric Acid. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Bromine, Br_2	Positive interference at all levels
Chlorine Dioxide, ClO_2	Positive interference at all levels
Inorganic chloramines	Positive interference at all levels
Chloramines, organic	May interfere in the result for total chlorine analysis
Hardness	No effect at less than 1000 mg/L as $CaCO_3$

Interfering substance	Interference level
Manganese, Oxidized (Mn^{4+}, Mn^{7+}) or Chromium, Oxidized (Cr^{6+})	Pre-treat the sample as follows: 1. Adjust the sample pH to 6–7. 2. Add 3 drops of Potassium Iodide (30-g/L) to 10 mL of sample. 3. Mix and wait 1 minute. 4. Add 3 drops of Sodium Arsenite (5-g/L) and mix. 5. Use the test procedure to measure the concentration of the treated sample. 6. Subtract this result from the result without the treatment to obtain the correct chlorine concentration.
Monochloramine	Causes a gradual drift to higher readings. When read within 1 minute after reagent addition, 3 mg/L monochloramine causes less than a 0.1 mg/L increase in the reading.
Ozone	Positive interference at all levels
Peroxides	May interfere
Highly buffered samples or extreme sample pH	Can prevent the correct pH adjustment (of the sample) by the reagents. Sample pretreatment may be necessary. Adjust to pH 6–7 with acid (Sulfuric Acid, 1 N) or base (Sodium Hydroxide, 1 N). Correct the test result for the dilution caused by the volume additions.

Pollution prevention and waste management

If sodium arsenite was added to the sample for manganese or chromium interferences, the reacted samples will contain arsenic and must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations. must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations.

Accuracy check

Standard additions method

Use the standard additions method to validate the test procedure, reagents and instrument and to find if there is an interference in the sample.

Items to collect:

- Chlorine Standard Solution, 2-mL PourRite® Ampule, 25–30 mg/L (use mg/L on label)
- Ampule breaker
- Pipet, TenSette®, 0.1–1.0 mL and tips

1. Prepare three spiked samples: use the TenSette pipet to add 0.1 mL, 0.2 mL and 0.3 mL of the standard solution, respectively, to three 10-mL portions of fresh sample. Mix well.
2. Use the test procedure to measure the concentration of each of the spiked samples. Start with the smallest sample spike. Measure each of the spiked samples in the instrument.
3. Compare the expected result to the actual result. The expected increase in the chlorine concentration is the Cl_2 mg/L concentration from the label of the standard solution multiplied by 0.1 mL for every 10 mL of standard solution added.

Standard solution method

If the Standard Calibration Adjust feature is used to adjust the calibration curve of the DR300 or Pocket Colorimeter II, the concentration of the chlorine standard must be between 0.50 and 1.50 mg/L chlorine for the LR procedure.

Method performance

The method performance data that follows was derived from laboratory tests that were measured on a DR300 and a Pocket Colorimeter II during ideal test conditions. Users can get different results under different test conditions.

Precision (95% confidence interval)
1.00 ± 0.05 mg/L Cl_2

Summary of method

Chlorine can be in water as free chlorine and as combined chlorine. Both forms can be in the same solution and can be determined together as total chlorine. Free chlorine is in a solution as hypochlorous acid or hypochlorite ion. Combined chlorine represents a combination of chlorine-containing compounds, including monochloramine, dichloramine, nitrogen trichloride and other chloro derivatives. The combined chlorine oxidizes iodide (I^-) to iodine (I_2). The iodine and free chlorine reacts with DPD (N,N-diethyl-p-phenylenediamine) to form a red solution. The color intensity is proportional to the chlorine concentration. To determine the concentration of combined chlorine, complete a free chlorine test and a total chlorine test. Subtract the results of the free chlorine test from the total chlorine test to get the combined chlorine concentration.

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
SwifTest™ DPD Free Chlorine Reagent	1 dispensations	each	2802300

Required apparatus

Description	Quantity/test	Unit	Item no.
Sample cells, 10-mL round, 25 mm x 60 mm	2	6/pkg	2427606

Recommended standards and apparatus

Description	Unit	Item no.
Chlorine Standard Solution, 2-mL PourRite® Ampules, 25–30 mg/L	20/pkg	2630020
PourRite® Ampule Breaker, 2-mL	each	2484600

Optional reagents and apparatus

Description	Unit	Item no.
Mixing cylinder, graduated, 25-mL	each	2088640
Potassium Iodide, 30-g/L	100 mL	34332
Sodium Arsenite, 5-g/L	100 mL	104732
Sodium Hydroxide Standard Solution, 1.0 N	100 mL MDB	104532
Sulfuric Acid Standard Solution, 1 N	100 mL MDB	127032
Pipet, TenSette®, 0.1–1.0 mL	each	1970001
Pipet tips for TenSette® Pipet, 0.1–1.0 mL	50/pkg	2185696
Pipet tips for TenSette® Pipet, 0.1–1.0 mL	1000/pkg	2185628
Paper, pH, 0–14 pH range	100/pkg	2601300
DPD Free Chlorine Reagent, 10-mL, SwifTest™ Dispenser refill vial	250 tests	2105560
SpecCheck™ Secondary Standard Kit, Chlorine DPD, 0–2.0 mg/L Set	each	2635300
Water, organic-free	500 mL	2641549

Chlorine, Total, Low Range

DOC316.53.01487

USEPA DPD Method[1] **Method 8167**

0.02 to 2.0 mg/L Cl_2 **SwifTest™ Dispenser**

Scope and application: For testing total chlorine in water, treated waters and wastewater. USEPA accepted for reporting for drinking water analyses.[2] This product has not been evaluated to test for chlorine and chloramines in medical applications in the United States.

[1] USEPA accepted for reporting wastewater and drinking water analyses.
[2] Procedure is equivalent to USEPA method 330.5 for wastewater and Standard Method 4500-Cl G for drinking water.

Test preparation

Before starting

Analyze the samples immediately. The samples cannot be preserved for later analysis.
Always do tests in sample cells. Do not put the instrument in the sample or pour the sample into the cell holder.
Make sure that the sample cells are clean and there are no scratches where the light passes through them.
Rinse the sample cell and cap with the sample three times before the sample cell is filled.
Make sure that there are no fingerprints or liquid on the external surface of the sample cells. Wipe with a lint-free cloth before measurement.
Cold waters can cause condensation on the sample cell or bubbles in the sample cell during color development. Examine the sample cell for condensation or bubbles. Remove condensation with a lint-free cloth. Invert the sample cell to remove bubbles.
Install the instrument cap over the cell holder before ZERO or READ is pushed.
Do not use the same sample cells for free and total chlorine. If trace iodide from the total chlorine reagent is carried over into the free chlorine determination, monochloramine will interfere. It is best to use separate, dedicated sample cells for free and total chlorine measurements.
If the test result is over-range, or if the sample temporarily turns yellow after the reagent addition, dilute the sample with a known volume of high quality, chlorine demand-free water and do the test again. Some loss of chlorine may occur due to the dilution. Multiply the result by the dilution factor. Additional methods are available to measure chlorine without dilution.
After the test, immediately empty and rinse the sample cell. Rinse the sample cell and cap three times with deionized water.
For the best results, measure the reagent blank value for each new lot of reagent. Replace the sample with deionized water in the test procedure to determine the reagent blank value. Subtract the reagent blank value from the sample results.
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.
Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

Items to collect

Description	Quantity
SwifTest™ DPD Total Chlorine Reagent	1 dispensation
Sample cells, 25-mm (10 mL)	2

Refer to Consumables and replacement items on page 5 for order information.

Sample collection

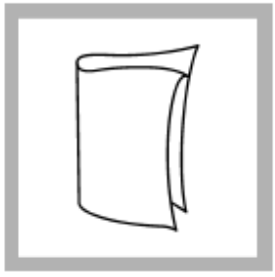
- Analyze the samples immediately. The samples cannot be preserved for later analysis.
- Chlorine is a strong oxidizing agent and is unstable in natural waters. Chlorine reacts quickly with various inorganic compounds and more slowly with organic compounds. Many factors, including reactant concentrations, sunlight, pH, temperature and salinity influence the decomposition of chlorine in water.
- Collect samples in clean glass bottles. Do not use plastic containers because these can have a large chlorine demand.
- Pretreat glass sample containers to remove chlorine demand. Soak the containers in a weak bleach solution (1 mL commercial bleach to 1 liter of deionized water) for at least 1 hour. Rinse fully with deionized or distilled water. If sample containers are rinsed fully with deionized or distilled water after use, only occasional pretreatment is necessary.
- Make sure to get a representative sample. If the sample is taken from a spigot or faucet, let the water flow for at least 5 minutes. Let the container overflow with the sample several times and then put the cap on the sample container so that there is no headspace (air) above the sample.

SwifTest™ dispenser procedure

1. Set the instrument to low range (LR).

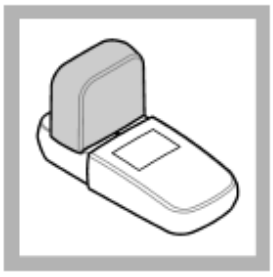
For DR300, push the up arrow button. For PCII, push the menu button, checkmark button, then the menu button again.

2. Prepare the blank: Rinse a sample cell and cap three times with sample. Fill the sample cell to the 10-mL mark with sample. Close the sample cell.



3. Clean the blank sample cell.

4. Insert the blank into the cell holder. Point the diamond mark on the sample cell toward the keypad.

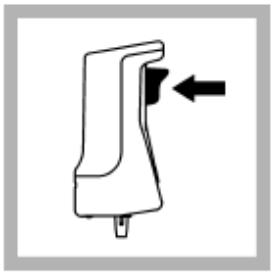


5. Install the instrument cap over the cell holder.

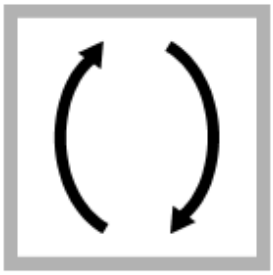
6. Push **ZERO**. The display shows "0.00".

7. Remove the sample cell from the cell holder.

8. Prepare the sample: Rinse a second sample cell and cap three times with sample. Fill the sample cell to the 10-mL mark with sample.



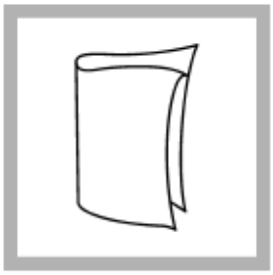
9. Add one dispensation of DPD Total Chlorine Reagent to the second sample cell.



10. Close the sample cell. Invert the sample cell for about **20 seconds** to dissolve the reagent. Undissolved power will not affect accuracy.

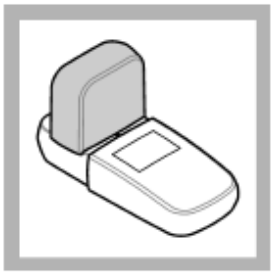
A pink color will show if chlorine is in the sample.

11. Set and start a timer for 3 minutes. A 3-minute reaction time starts.



12. When the timer expires, clean the prepared sample cell.

13. Within 6 minutes of the reagent addition, insert the prepared sample into the cell holder. Point the diamond mark on the sample cell toward the keypad.



14. Install the instrument cap over the cell holder.

15. Push **READ**. Results show in mg/L Cl_2.

Interferences

Interfering substance	Interference level
Acidity	More than 150 mg/L $CaCO_3$. The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sodium Hydroxide. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Alkalinity	More than 250 mg/L $CaCO_3$. The full color may not develop or the color may fade instantly. Adjust to pH 6–7 with 1 N Sulfuric Acid. Measure the amount to add on a separate sample aliquot, then add the same amount to the sample that is tested. Correct the test result for the dilution from the volume addition.
Bromine, Br_2	Positive interference at all levels
Chlorine Dioxide, ClO_2	Positive interference at all levels
Inorganic chloramines	Positive interference at all levels
Chloramines, organic	May interfere in the result for total chlorine analysis
Hardness	No effect at less than 1000 mg/L as $CaCO_3$

Interfering substance	Interference level
Manganese, Oxidized (Mn^{4+}, Mn^{7+}) or Chromium, Oxidized (Cr^{6+})	Pre-treat the sample as follows: 1. Adjust the sample pH to 6–7. 2. Add 3 drops of Potassium Iodide (30-g/L) to 10 mL of sample. 3. Mix and wait 1 minute. 4. Add 3 drops of Sodium Arsenite (5-g/L) and mix. 5. Use the test procedure to measure the concentration of the treated sample. 6. Subtract this result from the result without the treatment to obtain the correct chlorine concentration.
Monochloramine	Causes a gradual drift to higher readings. When read within 1 minute after reagent addition, 3 mg/L monochloramine causes less than a 0.1 mg/L increase in the reading.
Ozone	Positive interference at all levels
Peroxides	May interfere
Highly buffered samples or extreme sample pH	Can prevent the correct pH adjustment (of the sample) by the reagents. Sample pretreatment may be necessary. Adjust to pH 6–7 with acid (Sulfuric Acid, 1 N) or base (Sodium Hydroxide, 1 N). Correct the test result for the dilution caused by the volume additions.

Pollution prevention and waste management

If sodium arsenite was added to the sample for manganese or chromium interferences, the reacted samples will contain arsenic and must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations. must be disposed of as a hazardous waste. Dispose of reacted solutions according to local, state and federal regulations.

Accuracy check

Standard additions method

Use the standard additions method to validate the test procedure, reagents and instrument and to find if there is an interference in the sample.

Items to collect:

- Chlorine Standard Solution, 2-mL PourRite® Ampule, 25–30 mg/L (use mg/L on label)
- Ampule breaker
- Pipet, TenSette®, 0.1–1.0 mL and tips

1. Prepare three spiked samples: use the TenSette pipet to add 0.1 mL, 0.2 mL and 0.3 mL of the standard solution, respectively, to three 10-mL portions of fresh sample. Mix well.
2. Use the test procedure to measure the concentration of each of the spiked samples. Start with the smallest sample spike. Measure each of the spiked samples in the instrument.
3. Compare the expected result to the actual result. The expected increase in the chlorine concentration is the Cl_2 mg/L concentration from the label of the standard solution multiplied by 0.1 mL for every 10 mL of standard solution added.

Standard solution method

If the Standard Calibration Adjust feature is used to adjust the calibration curve of the DR300 or Pocket Colorimeter II, the concentration of the chlorine standard must be between 0.50 and 1.50 mg/L chlorine for the LR procedure.

Method performance

The method performance data that follows was derived from laboratory tests that were measured on a DR300 and a Pocket Colorimeter II during ideal test conditions. Users can get different results under different test conditions.

Precision (95% confidence interval)
1.00 ± 0.05 mg/L Cl_2

Summary of method

Chlorine can be in water as free chlorine and as combined chlorine. Both forms can be in the same solution and can be determined together as total chlorine. Free chlorine is in a solution as hypochlorous acid or hypochlorite ion. Combined chlorine represents a combination of chlorine-containing compounds, including monochloramine, dichloramine, nitrogen trichloride and other chloro derivatives. The combined chlorine oxidizes iodide (I^-) to iodine (I_2). The iodine and free chlorine reacts with DPD (N,N-diethyl-p-phenylenediamine) to form a red solution. The color intensity is proportional to the chlorine concentration. To determine the concentration of combined chlorine, complete a free chlorine test and a total chlorine test. Subtract the results of the free chlorine test from the total chlorine test to get the combined chlorine concentration.

Consumables and replacement items

Required reagents

Description	Quantity/test	Unit	Item no.
SwifTest™ DPD Total Chlorine Reagent	1 dispensations	each	2802400

Required apparatus

Description	Quantity/test	Unit	Item no.
Sample cells, 10-mL round, 25 mm x 60 mm	2	6/pkg	2427606

Recommended standards and apparatus

Description	Unit	Item no.
Chlorine Standard Solution, 2-mL PourRite® Ampules, 25–30 mg/L	20/pkg	2630020
PourRite® Ampule Breaker, 2-mL	each	2484600

Optional reagents and apparatus

Description	Unit	Item no.
Mixing cylinder, graduated, 25-mL	each	2088640
Potassium Iodide, 30-g/L	100 mL	34332
Sodium Arsenite, 5-g/L	100 mL	104732
Sodium Hydroxide Standard Solution, 1.0 N	100 mL MDB	104532
Sulfuric Acid Standard Solution, 1 N	100 mL MDB	127032
Pipet, TenSette®, 0.1–1.0 mL	each	1970001
Pipet tips for TenSette® Pipet, 0.1–1.0 mL	50/pkg	2185696
Pipet tips for TenSette® Pipet, 0.1–1.0 mL	1000/pkg	2185628
Paper, pH, 0–14 pH range	100/pkg	2601300
DPD Total Chlorine Reagent, 10-mL, SwifTest™ Dispenser refill vial	250 tests	2105660
SpecCheck™ Secondary Standard Kit, Chlorine DPD, 0–2.0 mg/L Set	each	2635300
Water, organic-free	500 mL	2641549

Appendix C

Sewage Lagoon Decant

Workflow:

1. In the spring allow a fair amount of ice to thaw from the sewage lagoon. Generally late June or early July and time it with the monthly charter flight.

2. Collect a sample from EUR-3 as outlined in Section 6.3.3.

3. Prepare the sample for transport to laboratory for toxicity analysis.

4. Allow the lab sufficient time to conduct their test. Generally about 10 business days.

5. After 10 business days request a copy of the analysis from the lab even if it is still only preliminary. The final should arrive within a few days.

6. Forward the results to CSFB. CSFB will forward the results to the CIRNAC Inspector for approval to decant the lagoon. This could take 10 business days.

7. **Only after approval is granted by CIRNAC can the lagoon be decanted.**

8. The quantity of discharge needs to be measured and recorded.
    a. Set up the flow meter between the pump and discharge hose.
    b. Record the date, time and meter reading before engaging the pump.
    c. Decant the lagoon until there is only minimal sewage and ice remaining.
    d. Stop the pump and record the date, time and meter reading again.

9. Allow the remainder of the ice to thaw. Repeat the process for each month of open water conditions (June, July and August).

10. The final August decant prepares the lagoon to survive the winter without a spill.