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

— Eureka High Arctic Weather Station —

In support of the
Nunavut Water Board License
No. 3BC-EUR0611

Prepared by Environment Canada
Assets, Contracting and Environmental Management Directorate (ACEMD)

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Control Page

On receipt of revisions and/or amendments, the Assets, Contracting and Environmental Management Directorate (ACEMD) 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.

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Acronyms

ACEMD	Assets, Contracting and Environmental Management Directorate
HAWS	High Arctic Weather Station
PEARL	Polar Environment Atmospheric Research Lab
pH	Measure of acidity and alkalinity
QA	Quality Assurance
QC	Quality Control
SNMP	Surveillance Network Monitoring Program
UV	Ultraviolet

1. Introduction

This document has been prepared in response to the requirements of the Nunavut Water Board License number 3BC-EUR0611, issued to Environment Canada on February 6, 2006. Specifically, this document satisfies the requirements set out in the above mentioned license, Part J, point 7, which states:

“The Licensee shall submit to the Board for approval, within three (3) months of the issuance of this Licence, a Quality Assurance/Quality Control (QA/QC) Plan, based on the principals of the INAC “QA/QC Guidelines for Licensees”, that addresses the field and laboratory procedures and requirements needed to carry out the monitoring program.”

The requirements of the Nunavut Water Board License number 3BC-EUR0611 specifically target Environment Canada's Eureka High Arctic Weather Station (HAWS) which is located on the north side of Slidre Fjord, at the north-western tip of Fosheim Peninsula on Ellesmere Island at 80° 0' N and 85°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 Environment Canada, the Department of National Defence, the Polar Continental Shelf Project, and the Polar Environment Atmospheric Research Lab (PEARL). 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 40 (this includes the members of the Department of National Defence).

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. Assessment of the quality of drinking water. Some analyses may be done on site and some may be contracted out.
2. Assessment of the quality of wastewater discharge.
3. Assessment of the quality of runoff from disposal site of solid waste.

The interpretation of QA/QCs for the purpose of this document follows those specified in the report entitled "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 (INAC, 1996).

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

- **Quality Assurance:** is the system of activities designed to better ensure that quality control is done effectively.
- **Quality Control:** is the use of established procedures to achieve standards of measurement for the three principal components of quality: precision, accuracy and reliability.

3. Sample Collection

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

3.1 Location

A number of locations were selected for collecting sample. They are described in further details below.

3.1.1 Raw Water Supply and Drinking Water

For the purpose of the Surveillance Network Monitoring Program (SNMP) four sampling stations have been identified:

1. Tank room before filtration
2. Tap in the weather office
3. Reverse osmosis in the weather office
4. Kitchen tap

The first sampling station is located in the tank room, before the filtration. It is representative of a raw source water, whereas the other three stations are representative of water following treatment, prior to being used for the various needs at Eureka HAWS.

3.1.2 Assessment of Runoff from the Solid Waste Disposal Facilities

Water samples and one soil sample are collected to assess the runoff from the solid waste disposal facilities. Water samples are collected to assess the water quality of the runoff/ponds at the bottom of the soil treatment cell.

3.1.3 Discharge from the Sewage Lagoon

The samples for the SNMP are collected at the end of the discharge pipe that is used to empty the sewage lagoon. It is also set at a certain distance downstream from the discharge point to assess the water quality in the mixing zone.

3.2 Sampling Equipment

No specialized equipment is required to collect the water and soil samples. All bottles are provided by the laboratory which carries out the analysis of the samples.

3.3 Sampling Methods

The following section describes the various sampling methods used at Eureka HAWS.

3.3.1 Raw and Treated Drinking Water

The sampling methods and description of the analysis are provided in Appendix A. The Board did not provide any specifications with respect to sampling or analysis requirements for this media.

3.3.2 Solid Waste Disposal Facilities

No specialized sampling methods are used for the collection of these samples. No field blanks or duplicates have been collected in 2005 or 2006. All future sampling events shall contain at least one set of field duplicates.

3.3.3 Discharge from Sewage Lagoon

A collection container is used to collect sufficient samples from the discharge pipe to fill the necessary sampling bottles. The container is rinsed three times prior to filling for the purpose of collecting the required sample. The samples from the mixing zone located downstream of the discharge point are collected directly into the required bottles (see section 4.1).

4. Sample Handling

The following section describes the procedures for handling the samples collected at Eureka HAWS.

4.1 Preservation

The samples of raw and treated drinking water do not require any preservation since all related tests are carried out on-site. Also, there is no specified holding time for these samples.

The samples collected from the solid waste disposal area are preserved using the following methods:

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

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

The samples collected from the sewage lagoon discharge and mixing zone are preserved using the following methods:

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

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

4.2 Sample Identification

The samples of drinking water collected at the four points identified in Section 3.1.1 shall be clearly labelled using consistent terminology.

The samples from the treatment cell and from the solid waste disposal facility shall be identified by labels in the following manner:

From Treatment cell: Eureka-TC-Year-sample #
An example: **Eureka-TC-2007-1**

From sewage lagoon discharge:
For samples collected from sewage pipe discharge: Eureka-WW-SL-Year-sample #
An example: **Eureka-WW-SL-2007-1**

For samples collected from mixing zone: Eureka-WW-MZ-Year-sample #
An example: **Eureka-WW-MZ-2007-1**

All sampling points shall be clearly identified using GPS positioning or clear narrative descriptive accompanied by as many photographs as necessary to ensure that identical sampling location can be used in the following year(s).

A clear Chain of Custody record shall be generated at the time of sampling, and shall be part of the final report describing the sampling and results by either Environment Canada personnel or by contractors. The record shall contain the following information:

- Identification of sampling site – general and specific (example: Eureka – Waste Water);
- Sample ID;
- Date and time 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.

4.3 Transportation

Samples from all media shall be stored on-site in appropriate storage containers (coolers with ice packs is ideal). The samples shall 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 shall then have to be timed to coincide with a plane going to the location where the samples shall be analyzed. The samples, when shipped, shall be well packed to protect them from any harm along the way, especially if glass bottles are used. Also, if required, a label shall 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).

5. Laboratory Analyses

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

5.1 Laboratory Accreditation

Analysis of all samples collected for the Eureka Haws SNMP, in support of the water license shall be carried out by an accredited laboratory, ideally accredited

by the Canadian Association for Environmental Analytical Laboratories (C.A.E.A.L). The laboratory shall 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.

5.2 Detection Limits

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

5.3 Laboratory Methods

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

6. Reporting Requirements

Eureka HAWS shall select two sampling points in their SNMP and shall collect duplicate samples at these sampling points. These shall serve as internal/external check for Eureka HAWS and the commercial laboratory.

Each full report for the SNMP shall 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.

7. References

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.*

Appendix A

Methods Used by Eureka HAWS for Monthly Testing of Drinking Water

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 60.5°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

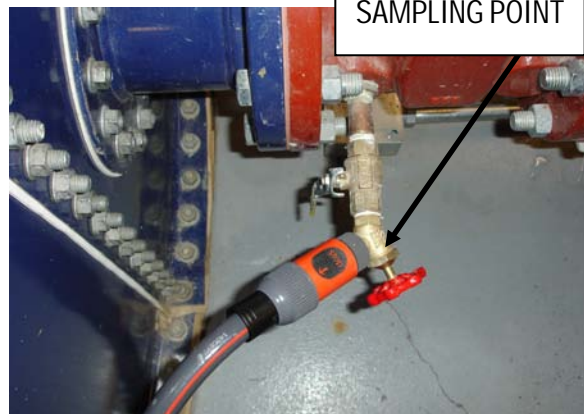
You Will Need: HACH Pocket Pal pH Tester (in Test Kit)
100mL Nalgene beaker
Distilled water



TANK ROOM SAMPLING HOSE



SAMPLING POINT



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 ~15 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.

Result 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