



July 16, 2003

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File: CAM-4 (3.6)

Dear Ms. Beaulieu:

RE: Updated QA/QC Plan for Water Use Licence NWB5PEL0104

UMA Engineering Ltd., on behalf of Defence Construction Canada and the Department of National Defence, is submitting an updated Quality Assurance/Quality Control Plan for the work at CAM-4, Pelly Bay. This document is being submitted as per Water Use Licence NWB5PEL0104.

We trust the enclosed document provides sufficient information to meet the requirements of the Water Use Licence.

Please feel free to contact the undersigned if you have any questions or require further information.

Sincerely,

UMA ENGINEERING LTD.

Eva Schulz, P.Ag.
Environmental Scientist
eschulz@umagroup.com

Encl. QA/QC Plan

cc: Jim Wall, NWB - Cambridge Bay via e-mail

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030716 NWB5PEL Updated QAQC Plan - ILAE

QUALITY ASSURANCE (QA)
AND QUALITY CONTROL (QC) PLAN
FOR THE COLLECTION OF WATER SAMPLES
AT THE
CAM-4 (PELLY BAY)
DEW LINE SITE

JULY 2003

Prepared by:
ENVIRONMENTAL SCIENCES GROUP
for
DEFENCE CONSTRUCTION CANADA
&
UMA ENGINEERING LTD.

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1. Introduction

During the clean-up of the CAM-4 DEW Line site at Pelly Bay (Kugaaruk), Nunavut samples will be collected from the following locations as required by the Water Use License:

1. effluent from the Landfarm Facility or its associated perimeter collection trenches; and
2. runoff from the Tier II Soil Disposal Facility, Upper Site Landfill, Lower Site Landfill, Abandoned Camp Landfill, Barrow Lake Landfill and/or USAF Landfill.

As stated in the Water Use License, the required analytes are as follows:

- pH;
- Major ions (sodium, potassium, calcium, magnesium, iron and manganese);
- Conductivity;
- PCBs;
- Total suspended solids (TSS);
- Hardness;
- Total petroleum hydrocarbons (TPH); and
- Inorganic elements (total arsenic, total and dissolved cadmium, dissolved cobalt, dissolved copper, dissolved lead, total mercury, dissolved nickel, and, total zinc) by ICP scan.

2. Sample Collection

2.1. Location

Sample locations are marked with a disk stamped with the sample number and a piece of flagging tape, attached with a 150-mm nail. Each sample location is assigned a distinct sample number. These sample numbers are recorded on a map as well as in a field notebook along with a description of the associated sample location.

2.2. Sampling Equipment

The following table summarizes the equipment and storage requirements for each water sample type collected. New bottles are used in all cases for the collection of the water samples.

Contaminant	Container	Amount	Rinse	Storage	Special Treatment
Major ions, pH, TSS, conductivity, hardness	1L Plastic Bottle	Full	No	Cool	Do not filter
Inorganic elements (by ICP)	1L Acidified Plastic Bottle	Full	No	Cool	Do not filter Acidify with HNO ₃ to pH<2*
TPH	250 mL amber glass bottle	Full – no headspace	No	Cool	Do not filter
PCBs	1L Teflon bottle or 1 L amber glass bottle	Full	Teflon – yes Glass - no	Cool	Do not filter

*Generally it is not possible to acidify the samples in the field due to TDGA regulations. Therefore, the samples are acidified immediately upon receipt in the laboratory, prior to extraction

2.3.Sampling Methods

Sample bottles will be filled completely at the time of sampling. Bottles are not to be filled progressively over the course of days. If there is not sufficient water to completely fill the bottle(s), then no water sample will be collected. The bottles are to be filled with no headspace remaining to guard against volatilization of dissolved phases. Generally, the samples will be collected immediately prior to departure from the site and submitted for analysis within 48 hours.

3. Sample Handling

3.1.Preservation

The water samples will be kept cool (approximately 4⁰ C) prior to and during shipping. In general, water samples will be collected when transportation from the site will be available almost immediately after, as many types of the required analyses need to be performed as quickly as possible after collection.

Ideally, samples collected for inorganic analyses should be acidified in the field, at the time of collection. However, regulations concerning the transportation of dangerous goods make supplying concentrated acids in the field difficult. Where samples cannot be acidified in the field, it will be requested that the samples are acidified immediately upon

receipt in the lab, *prior* to decanting or sample extraction. When acidifying in the lab, the container will be rinsed with 35% HNO₃ and included with the sample.

Samples are not to be filtered at any time. If samples contain excessive sediment, the samples will simply be decanted in the southern laboratory (*following* acidification, for metal analyses) prior to analysis.

3.2. Sample Identification

Each water sample will be given a blind number that is number provided on the labels of samples submitted for analysis. This sample number corresponds to the number assigned to that specific sample location which will be recorded on a map and in the field notebook.

3.3. Transportation

Samples are to be shipped by guaranteed airfreight in coolers from the site to their respective accredited laboratory for analysis. Chain-of-custody forms will be filled out and checked for each sample before shipment from the North, and the contents of shipments will be verified upon receipt in the laboratory.

4. Lab Analysis

4.1. Lab Accreditation

All laboratory analysis is carried out at accredited labs. The following laboratories are the ones primarily responsible for the analysis of water samples collected at CAM-4 (Pelly Bay):

- 1) Analytical Services Unit, Queen's University, Kingston ON; and
- 2) Analytical Sciences Group, Royal Military College of Canada, Kingston ON.

Accreditation certificates from these laboratories are available upon request.

4.2. Detection Limits

The following table provides a summary of the detection limits for the analysis to be performed on water samples collected at CAM-4 (Pelly Bay).

Parameter	Detection Limit
Sodium	1.0 mg/L
Potassium	0.2 mg/L
Calcium	0.05 mg/L
Magnesium	0.01 mg/L
Iron	0.05 mg/L
Manganese	0.01 mg/L
PH	n/a
Conductivity	1 uS-cm
Total suspended solids (TSS)	1 mg/L
Total petroleum hydrocarbons (TPH)	1 mg/L
PCBs	3.0 ug/L
Total arsenic	0.003 mg/L
Dissolved cadmium	0.001 mg/L by ICP
Dissolved cobalt	0.003 mg/L by ICP
Dissolved copper	0.005 mg/L by ICP
Dissolved lead	0.010 mg/L by ICP
Dissolved nickel	0.005 mg/L by ICP
Total zinc	0.01 mg/L by ICP
Total mercury	0.0005 mg/L by ICP

4.3. Methodology

The following is a summary of the methods to be used in the analysis of the water samples collected from CAM-4 (Pelly Bay).

4.3.1. pH

Analyses are conducted by the Analytical Services Unit, Queen's University, Kingston, Ontario. Each sample is clearly labelled and stored at low temperatures in a secured area before and after analysis.

Water samples are measured directly using a 50-mL sample. pH is measured with a Fisher Scientific Accumet Model 10 pH meter and probe.

4.3.2. Major Ions (Sodium, Potassium, Magnesium, Calcium, Iron and Manganese) in Water

Analyses are conducted by the Analytical Services Unit, Queen's University, Kingston, Ontario. Each sample is clearly labelled and stored at low temperatures in a secured area before and after analysis.

Each water sample (400 mL) is placed with 3 mL of nitric acid in a beaker on a hot plate and slowly boiled to dryness. To this, 20 mL of 2% nitric acid is added. The sample is heated to boiling, cooled, and made up to 25 mL with distilled deionized water. The resulting solutions are analyzed by AAS for the selected elements. Blanks, duplicates (when enough sample is provided) and control standards are run with every set of samples. Concentrations are calculated by comparison to a standard curve. Results are reported as mg/L.

4.3.3. Conductivity

Analyses are conducted by the Analytical Services Unit, Queen's University, Kingston, Ontario. Each sample is clearly labelled and stored at low temperatures in a secured area before and after analysis.

Conductivity is measured using a Fisher Scientific conductivity meter. The probe is placed in a minimum of approximately 20 mL of sample. The sample is stirred during the measurement and the reading is taken once the meter stabilizes. The meter is calibrated with three conductivity standards.

4.3.4. PCBs in Water

Analyses are conducted by the Analytical Services Group, Royal Military College, Kingston, Ontario. Each sample is clearly labelled and stored at low temperatures in a secured area before and after analysis.

An 800-mL sample is placed in a 1-L separatory funnel and spiked with DCBP, an internal standard. Dichloromethane (25 mL) is added to the separatory funnel, which is then shaken with frequent venting. The bottom layer is decanted through a funnel containing anhydrous sodium sulphate and into a round-bottom flask. This extraction step is repeated twice more, giving a collected volume of 75 mL in the round-bottom flask. The solvent in the flask is then exchanged for hexane by rotary evaporation of the

original 75 mL down to 1 mL, and 5 mL of hexane are added and again evaporated to 1 mL. The addition of 5 mL of hexane is repeated twice more, to give a final volume of 1 mL after the last rotary evaporation. The 1-mL volume remaining in the flask is pipetted onto a LC-Florisil solid phase extraction tube (Supelco) and eluted with hexane. The PCB concentrations are determined by running the resulting solutions on an HP/Agilent 6890 Plus gas chromatograph with ECD detector.

Analyses requiring ultra-low detection limits are similarly treated, but are concentrated to a known volume of approximately 0.5 mL after Florisil elution. Injection volumes of 2 mL are used in the GC analysis.

4.3.5. Total Suspended Solids (TSS)

Analyses are conducted by the Analytical Services Unit, Queen's University, Kingston, Ontario. Each sample is clearly labelled and stored at low temperatures in a secured area before and after analysis.

Total suspended solids (TSS) in water is determined by filtration of a sample through a glass fibre filter. A glass fiber filter is first dried in the oven at 105 °C for 15 minutes, allowed to cool and weighed. A measured volume of water (usually 500 ml) is poured through the filter, and the filter is oven-dried for two hours, cooled and reweighed. The TSS are reported as the difference in the weights divided by the volume of water.

4.3.6. Hardness

Analyses are conducted by the Analytical Services Unit, Queen's University, Kingston, Ontario. Each sample is clearly labelled and stored at low temperatures in a secured area before and after analysis.

Each water sample (400 mL) is placed with 3 mL of nitric acid in a beaker on a hot plate and slowly boiled to dryness. To this, 20 mL of 2% nitric acid is added. The sample is heated to boiling, cooled, and made up to 25 mL with distilled deionized water. The resulting solutions are analyzed by AAS for the selected elements. Blanks, duplicates (when enough sample is provided) and control standards are run with every set of samples. Concentrations are calculated by comparison to a standard curve. Results are reported as mg/L. Hardness is calculated from Ca and Mg values.

4.3.7. Total Petroleum Hydrocarbons (TPH) in Water

Analyses are conducted by the Analytical Services Group, Royal Military College, Kingston, Ontario. Each sample is stored in an appropriate, clearly labelled container and kept at low temperatures in a secured area before and after analysis.

For water samples, a 75-mL portion of the water sample is accurately measured and transferred to a clean 125-mL glass separatory funnel. Five mL of hexane are added and the mixture shaken vigorously and then allowed to separate. If emulsions form, the funnel is briefly sonicated to ensure adequate phase separation. Some of the hexane phase is then transferred to a GC vial.

Samples are analyzed by gas chromatography on a SPB-1 fused silica capillary column (30 m, 0.25 mm i.d. x 0.25 μ m film thickness). TPH is quantified by comparing the chromatogram peak area of the sample with standards of fuel oil and lubricating oil standards prepared in hexane. Compound identity is determined by comparing the sample chromatogram with those of known hydrocarbons.

4.3.8. Inorganic Elements by Inductively Coupled Plasma (ICP) Atomic Emission Spectroscopy

Analyses are conducted by the Analytical Services Unit, Queen's University, Kingston, Ontario. Each sample is clearly labelled and stored at low temperatures in a secured area before and after analysis.

Each water sample (400 mL), with 3 mL of nitric acid, is placed in a beaker on a hot plate and slowly boiled to dryness. To this is added 20 mL of 2% nitric acid. The sample is then heated to boiling, cooled, and made up to 25 mL with distilled deionized water. The resulting solutions are analyzed by ICP-AES for the selected eight elements: arsenic (As), cadmium (Cd), chromium (Cr), cobalt (Co), copper (Cu), lead (Pb), nickel (Ni), and zinc (Zn).

4.4. Reporting Requirements

The following types of QA/QC samples will also be collected as part of the water sampling program. Note that if more than one type of bottle is used for each water sample, QA/QC samples will be submitted in each type of bottle used for the collection of the samples.

Field duplicates: Approximately 10% of the samples are collected as field duplicates. That is, two samples are collected from one sample location. These samples are handled in the same way and submitted blindly to the laboratories for analysis.

Field blanks: Field blanks consist of distilled water and are collected to ensure that there is no corruption of samples from the sampling method. The distilled water is poured from its container into the sample container at the same time and using the same techniques as is used to collect the regular water samples.

Travel blanks: The purpose of travel blanks is to ensure that there is no corruption of the sample or sample container during travel. Ideally, a full set of travel blanks should accompany each shipment of water samples. However, in cases where very few samples are shipped at a time, this guideline can be extended to a more reasonable number. Travel blanks are filled at ESG prior to leaving for the field. They are shipped with the sample bottles, stored with the sample bottles on site, brought out to the sampling location in the field, returned to the lab, and shipped to the labs with the water samples. They should not be opened unless the other bottles or water samples are opened for some reason during shipping.