



**BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT**

**SURFACE WATER SAMPLING PROGRAM
QUALITY ASSURANCE AND QUALITY CONTROL PLAN**

Rev. No.	Revision	Date	Approved
0	Issued in Final	October 25, 2007	KDE
1	Issued for 2008 Field Season	March 31, 2008	KDE
2	Issued in Final	March 31, 2008	JM

Baffinland Iron Mines Corporation

Suite 1016, 120 Adelaide Street West, Toronto, ON Canada M5H 1T1

Tel: +1 (416) 364-8820 • Fax: +1 (416) 364-0193

www.baffinland.com

BAFFINLAND IRON MINES CORPORATION

MARY RIVER PROJECT

SURFACE WATER SAMPLING PROGRAM

QUALITY ASSURANCE AND QUALITY CONTROL PLAN

TABLE OF CONTENTS

	<u>PAGE</u>
SECTION 1.0 - INTRODUCTION.....	1
1.1 INTRODUCTION.....	1
1.2 QA/QC PLAN OBJECTIVES.....	1
SECTION 2.0 - SAMPLE COLLECTION.....	2
2.1 GENERAL	2
2.2 WATER QUALITY MONITORING LOCATIONS	2
2.3 SAMPLING METHODS AND EQUIPMENT.....	2
2.3.1 General Sampling Procedures	3
2.3.2 Lake Sampling.....	4
2.3.3 River Sampling	4
2.3.4 Sampling for Toxicity Testing	5
2.4 QA/QC SAMPLES.....	5
2.5 MEASUREMENT OF FIELD PARAMETERS	6
2.5.1 Monitoring Probe Calibration.....	6
SECTION 3.0 - SAMPLE MANAGEMENT	7
3.1 SAMPLE SHIPPING AND CHAIN OF CUSTODY	7
SECTION 4.0 - LABORATORY ANALYSIS	8
4.1 LABORATORY ACCREDITATION	8
4.2 ANALYTICAL DETECTION LIMITS.....	8
4.3 LABORATORY ANALYTICAL METHODS.....	8
4.4 ANALYTICAL LABORATORY QA/QC PROCEDURES	8
SECTION 5.0 - DATA MANAGEMENT AND REPORTING.....	9
5.1 DATA MANAGEMENT	9
5.2 REPORTING	9
SECTION 6.0 - REFERENCES.....	10

TABLES

Table 2.1	Rev. 1	Summary of Recommended Water Sample Volumes, Method Detection Limits, Preservatives and Sample Storage Times
Table 2.2	Rev. 1	Summary of Recommended Field QA/QC Water Samples

APPENDICES

Appendix A	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)
Appendix B	Example Forms
Appendix C	Analytical Laboratory Accreditation
Appendix D	Laboratory Analytical Methods
Appendix E	Analytical Laboratory QA/QC Procedures



BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

SURFACE WATER SAMPLING PROGRAM
QUALITY ASSURANCE AND QUALITY CONTROL PLAN
(REF. NO. NB102-00181/10-7)

SECTION 1.0 - INTRODUCTION

1.1 INTRODUCTION

This Quality Assurance and Quality Control (QA/QC) Plan has been prepared to fulfill the requirement of Part I, Item 9 of License No. 2BB-MRY0710 issued by the Nunavut Water Board to Baffinland Iron Mines Corporation (Baffinland) on July 27, 2007.

Part I, Item 9 of the Water License states:

The Licensee shall submit a Quality Assurance/Quality Control Plan, prepared in accordance with the INAC document "Quality Assurance (QA) and Quality Control (QC) Guidelines for use by Class "B" Licensees in Collecting Representative Water Samples in the Field, 1996" to an Analyst for approval within ninety (90) days of the issuance of the license (amendment). The plan shall include analysis of field blanks and certified reference material, and replicate sampling in order to assess accuracy, precision and field contamination.

In accordance with the stipulations of the Water License, this Surface Water Quality Sampling Program QA/QC Plan has been prepared following the general recommendations presented in *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). A copy of the guidelines is included in Appendix A.

1.2 QA/QC PLAN OBJECTIVES

For the purposes of this report, QA/QC is defined as:

- **Quality Assurance** - System of activities used to achieve quality control.
- **Quality Control** - Set of best practice methods and procedures used to ensure quality of data in terms of precision, accuracy and reliability.

The QA/QC best practices outlined in this document are designed to provide guidance to field staff and analytical laboratories in order to maintain a high level of confidence in the water quality data generated from the Mary River Project.

SECTION 2.0 - SAMPLE COLLECTION

2.1 GENERAL

The samples will be collected following the general recommendations presented in *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). A copy of the guidelines is included in Appendix A.

2.2 WATER QUALITY MONITORING LOCATIONS

The QA/QC Plan addresses the collection of freshwater surface water quality samples related to monitoring programs being carried out in support of Baffinland's Mary River Project, namely:

1. Collection of environmental surface water samples from area lakes, streams and rivers.
2. Collection of effluent samples from the current and future wastewater treatment facilities located at Mary River and Milne Inlet.
3. Collection of drinking water samples from camp potable water sources.
4. Collection of surface water discharges from future ore stockpiles and waste rock dumps.
5. Collection of surface water discharges from future bulk sample open pits.
6. Collection of water samples from fuel berms.
7. Collection of water samples representative of general site drainage.
8. Measurement of water sample field parameters (e.g. pH, conductivity, temperature etc.).

Exact locations and sampling frequency for designated monitoring stations are presented in the Site Water Management Plan (Knight Piésold, 2008).

2.3 SAMPLING METHODS AND EQUIPMENT

A summary of recommended water sample containers, sample volumes, method detection limits (MDL), sample preservatives and maximum sample hold times is presented in Table 2.1. Laboratory parameters such as pH, BOD, nitrite, nitrate, orthophosphate, fecal colliforms, chlorophyll and phenophytin typically have maximum sample storage times varying from 4 to 48 hours. Due to the remoteness of the site, it may not always be possible to get laboratory analysis done within the sample holding time window. During the preparation of this document the analytical laboratories were consulted with respect to maximum sample holding times. As a result, Table 2.1 presents a preferred and a maximum holding time for time sensitive parameters. Every effort will be made to get samples analysed within the preferred holding time window. If this is not possible, then the maximum holding time will apply.

Every effort will be made to prevent accidental freezing of bacteriological water samples (due to on-site climatic conditions) which could affect analytical results for these parameters.

For a complete list of the required sample analyses at each monitoring station, please refer to the Site Water Management Plan (Knight Piésold, 2008).

2.3.1 General Sampling Procedures

Generally, sampling procedures will consist of the following:

1. Sampler will wear a fresh pair of disposable nitrile gloves for each sampling event.
2. Sample bottles and preservative will be stored under clean conditions on site. Sample bottles will have the appropriate volume of preservative added in the field (or alternatively, sample bottles will be supplied by the analytical laboratory with preservatives already added).
3. A fresh sample bottle(s) will be used at each monitoring station. Sample bottles will *not* be re-used.
4. Sampling will be carried out by either: i) rinsing the sample bottle with source water three times before immersing the sample bottle to fill it (after which preservative is added, as required), or ii) if the sample bottles are provided pre-charged with preservatives then it is generally convenient to transfer water samples from the source to the sample bottle using a 1-2L plastic jug. Plastic jugs will be rinsed in the source water three times before filling the sample bottle. A dedicated jug will be used for different sample types (e.g. sewage effluent, fuel contaminated drainage and receiving waters). Sample jugs will be replaced on a regular basis before they become stained.
5. Prior to collecting the sample, the sampling jug will be rinsed in the source water three times. Rinse water will be disposed of so that it does not contaminate the source water where the sample will be collected.
6. Care will be taken to avoid disturbance of sediments and inclusion of disturbed suspended solids in the sample.
7. For samples *not requiring preservatives*, the sample bottle will be rinsed three times with source water before filling the bottle to the top.
8. For samples *requiring preservatives*, the sample bottle will be filled to the top (or to the indicator line marked on the bottle) and securely sealed. Note that for some volatile contaminants (e.g. BTEX), the sample bottle must be filled with zero headspace.
9. Sample details e.g. date, sample ID and analysis will be clearly marked on the bottle in indelible ink.
10. For *dissolved metals* analyses, if possible, the water sample will be filtered in the field immediately after sampling using a 0.45µm disposable filter and syringe. A fresh syringe and filters must be used at each monitoring station. Alternatively, sample filtration can be carried out by the analytical laboratory.
11. All samples will be sealed by ensuring their lids are tightly secured before placing the bottles into the coolers.
12. All samples will be placed in an iced cooler as soon as possible after collection.

2.3.2 Lake Sampling

For monitoring of water quality arising from vertical stratification in lakes, a depth sampler will be used (e.g. a 'Van Dorn' or 'Kemmerer'). Generally, depth samplers consist of a clear polycarbonate sample tube with two spring mounted rubber bungs, one located at each end. The depth sampler is lowered to the correct depth attached to a cord, whereupon a metal weight is released. The weight slides down the cord and strikes a release mechanism button which releases the two bungs which then seal both ends of the tube. The water sample is then pulled back to the surface.

Regardless of the brand, water samplers that are used will be suitable for collection of water samples for ultra low metals analyses i.e. will have acrylic or PVC construction and silicone seals.

For depth sampling, the following considerations will be taken into account to ensure sample QA/QC:

1. Sampling station locations will be dependent upon the monitoring program objectives and the lake dimensions. Map coordinates for all lake sampling station locations will be recorded using a GPS unit.
2. The vertical stratification profile will be determined using a temperature probe equipped with a long cord with metre intervals marked on it.
3. The vertical temperature profile will be established by slowly lowering the temperature probe and recording the temperature change with depth.
4. Depending upon the purpose of the monitoring program, water quality samples may be collected from the different stratified layers. The depth sampler must be slowly lowered in the 'open' position (i.e. to let water enter it) until it reaches the required depth.
5. The depth sampler will be held at this depth for a few minutes to allow flushing of water inside it.
6. The metal weight (messenger) will be released (to activate the closing mechanism) and the depth sampler will be pulled back to the surface. Field measurements can be taken at depth or by filling a bottle with the sampled water and taking measurements from that immediately after sampling.
7. When collecting samples close to the lake bed care must be taken to ensure that the depth sampler does not disturb lake bed sediments (which could contaminate the sample).
8. Depending upon the lake area and depth, multiple sampling stations will likely be required to adequately characterize lake water quality.

2.3.3 River Sampling

Depending upon the size of the water body, river sampling methods are the same as those presented in Sections 2.3.1 and 2.3.2. To avoid inclusion of floating detritus in the sample,

the sample bottle must be fully immersed in the river water. Care will be taken to ensure that disturbed sediments are not included in the sample.

When selecting water quality monitoring station locations on rivers, care will be taken where a tributary joins a river, since complete mixing of the two waters may not be achieved within several hundred metres downstream of the confluence (or further). When in doubt, vertical profile monitoring across the river's width using a field parameter such as pH, temperature or conductivity will be used to assess if complete mixing has occurred.

2.3.4 Sampling for Toxicity Testing

Sampling for sub-lethal toxicity testing is a condition of Environmental Effects Monitoring (EEM). Typically, a 4L effluent sample is sufficient. Depending upon the objectives of the toxicity testing, variables that will require confirmation prior to testing include:

- Type of effluent sample to be collected e.g. instantaneous grab sample, or composite sample collected over a period of time
- Type of dilution water to be used by the testing laboratory e.g. standard synthetic laboratory dilution water, receiving water collected upstream of the discharge etc.
- Preferred test organism e.g. *Daphnia magna* or rainbow trout

Brief details concerning laboratory methods are presented in Appendix D. For further details concerning acute lethality testing refer to Environment Canada (2002) and USEPA (2002).

2.4 QA/QC SAMPLES

For monitoring of QA/QC during sample collection and shipping, a set of QA/QC samples will be routinely submitted for analysis. Descriptions of the QA/QC samples that will be used (e.g. field blank, travel blank and field duplicate) are presented on Table 2.2. Ten percent of all samples will comprise QA/QC samples..

In the interest of transparency, the analytical laboratories will also be instructed to report the results of their own in-house QA/QC testing (e.g. results of random replicate analyses of submitted samples).

The results of QA/QC analyses will be routinely reviewed by Baffinland or their designate, and any anomalous results will be promptly investigated with the assistance of the analytical laboratory. Once the reason for the anomalous results is identified, Baffinland will ensure that operating procedures of field staff and/or the analytical laboratory will be altered in order to rectify the problem. Compliance monitoring and data management for water license sampling will be conducted by Baffinland, with the assistance of a designate as required.

2.5 MEASUREMENT OF FIELD PARAMETERS

Measurement of field parameters (e.g. temperature, pH, conductivity, redox potential, or dissolved oxygen, etc.), where warranted, will be carried out for each sample at the time of sampling. The required set of field parameters will vary according to sample type and monitoring objectives. For a complete list of required parameters please refer to the Site Water Management Plan (Knight Piésold, 2008). The exact methods used for monitoring field parameters will depend upon the type of monitoring probes being used. Field staff will read and be familiar with the instruction manual for the equipment being used on site.

Field staff will rinse the monitoring probe three times with the water to be monitored before immersing the probe in the water. Generally, the user will ensure that the probe being used has had sufficient time to equilibrate in the water before the reading is taken. This is generally regarded as the point at which the reading has stabilized.

Field parameter data will be recorded in notebooks, or preferably in a custom form designed for this purpose (see example in Appendix B). A copy of the data should be retained on site.

2.5.1 Monitoring Probe Calibration

Monitoring probes will be stored and calibrated in accordance with manufacturers' instructions. All probes will be calibrated before each sampling event and a written record of the calibration results will be maintained on site. Field staff will ensure that calibration solutions are of the correct specification and that they have not passed their expiry date (if applicable). Monitoring probes will be stored as per manufacturers' recommendations.

SECTION 3.0 - SAMPLE MANAGEMENT

3.1 SAMPLE SHIPPING AND CHAIN OF CUSTODY

Samples will be placed in iced coolers and shipped to the analytical laboratory as soon as possible after collection. Care will be taken to ensure that bottles are stored upright and are packed securely within the cooler. Preferably, leak-proof ice packs will be used for cooling the samples. If loose ice is used then this should be securely sealed in plastic bags to prevent leakage of melt water.

A chain of custody (COC) form will accompany the samples (see example forms presented in Appendix B). At a minimum, the COC form will list:

1. Project name and project assignment number.
2. Address of analytical laboratory, name of contact person and contact details.
3. Contact details and name of sampler.
4. Date and time of sampling.
5. Whether the sample has been filtered, or whether laboratory filtration is required.
6. List of sample I.D.'s, sample type (e.g. lake water, sewage effluent, etc.), number of sample bottles per sample and analysis requested.
7. Urgency of analysis (e.g. rush or normal). For rush samples the analytical laboratory should be notified ahead of time.
8. Whether sample contains preservative and if so, what preservative and when it was added.

SECTION 4.0 - LABORATORY ANALYSIS

4.1 LABORATORY ACCREDITATION

Currently, laboratory analysis of water samples is being carried out by two accredited analytical laboratories. Accutest Laboratories ('Accutest') located in Nepean, Ontario has been carrying out the majority of sample analyses due to its geographical proximity to site (with respect to sample holding times). ALS Laboratory Group ('ALS'), located in Vancouver, BC has been used when ultra low level metals analysis has been required. AquaTox Testing and Consulting Inc. ('AquaTox') located in Guelph, Ontario will provide toxicity testing services. Details on analytical laboratory accreditation are presented in Appendix C.

4.2 ANALYTICAL DETECTION LIMITS

Required analytical laboratory method detection limits for a range of parameters are listed in Table 2.1. It should be noted that on occasion, a loss of analytical sensitivity can be encountered due to excessively high concentrations of parameters within a sample. If this is encountered, Baffinland or their designate will work with the analytical laboratory to try and resolve the problem.

4.3 LABORATORY ANALYTICAL METHODS

Analytical methods used by the analytical laboratories generally conform to the standard methods outlined in *Standard Methods for the Examination of Water and Wastewater* (APHA et al, 1989). For some parameters alternative standard analytical methods are used, as listed in Appendix D.

4.4 ANALYTICAL LABORATORY QA/QC PROCEDURES

Each analytical laboratory carries out their own routine in-house QA/QC checks, which include:

- Use of calibration check standards and drift control standards
- Use of surrogate standards and internal standards
- Replicate analyses on submitted samples
- Use of standard reference materials (SRM's) and matrix spikes

Further details on the analytical laboratories in-house QA/QC protocols are presented in Appendix E.

SECTION 5.0 - DATA MANAGEMENT AND REPORTING

5.1 DATA MANAGEMENT

All water quality data collected by Baffinland or designate from the various environmental programs will be stored electronically in a spreadsheet database (Microsoft Excel) or using alternative software designed specifically for environmental data management.

QA/QC measures relating to data validation will include the following:

1. Designation of a suitable person to act as Water Quality Database Manager (WQDM).
2. Upon receipt, laboratory analytical data will be reviewed by the WQDM to check for completeness, typos, outlying values, etc. The analytical laboratory will be immediately notified of any anomalous results.
3. At a suitable frequency (e.g. once per month) the spreadsheet database should be updated by the WQDM using: i) results provided in electronic format by the analytical laboratories, and ii) copies of the field parameter monitoring records forwarded from site
4. The WQDM will be responsible for ensuring that a third party (e.g. another staff member) carries out a QA/QC check on a minimum of ten percent of newly entered data.

5.2 REPORTING

All documents prepared by Baffinland or their designate for submission to the regulators will be reviewed by senior staff and Baffinland prior to issue, as per the company's standard practice and quality management system.

SECTION 6.0 - REFERENCES

1. APHA *et al*, 1989. Standard Methods for the Examination of Water and Wastewater; APHA, AWWA and WPCF, 17th ed.
2. Environment Canada, 2002. Metal Mining Guidance Document for Aquatic Environmental Effects Monitoring. <http://www.ec.gc.ca/eem/English/MetalMining/Guidance/default.cfm>.
3. INAC, 1996. Quality Assurance (QA) and Quality Control (QC) Guidelines for Use by Class "B" Licenses in Collecting Representative Water Samples and the Field and for Submission of a QA/QC Plan. Prepared by Department of Indian and Northern Affairs Canada Water Resources Division and the Northwest Territories Water Board, July 1996.
4. Knight Piésold, 2008. Baffinland Iron Mines Corporation - Mary River Project - Site Water Management Plan, Ref. No. NB102-00181/10-5, Rev. 1. North Bay: Knight Piésold, 2008.
5. USEPA, 2002. Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms; 5th Ed., USEPA, ref. No. EPA-821-R-02-012.

TABLES

TABLE 2.1

**BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT**

SURFACE WATER SAMPLING PROGRAM - QUALITY ASSURANCE AND QUALITY CONTROL PLAN

SUMMARY OF RECOMMENDED WATER SAMPLE VOLUMES, METHOD DETECTION LIMITS, PRESERVATIVES AND SAMPLE STORAGE TIMES

Parameter	Method Detection Limit	Required Sample Bottle	Sample Preservative	Maximum Sample Storage Time	
				Preferred	Maximum
General Chemistry					
Total metals	variable	250mL plastic	0.5mL conc. nitric acid	6 months	-
Dissolved metals ⁽¹⁾	variable	250mL plastic	cool 4°C	7 days	-
Anions	variable	1L plastic	cool 4°C	7 days	-
TSS ⁽⁴⁾	3 mg/L	1L plastic	cool 4°C	7 days	-
pH	0.01 pH unit	250mL plastic	cool 4°C	4 hours	14 days
Conductivity	0.2µS/cm	250mL plastic	cool 4°C	28 days	-
Total hardness	0.5mg/L	250mL plastic	cool 4°C	6 months	-
Total acidity / alkalinity	0.5mg/L	500mL plastic	cool 4°C	14 days	-
Nutrients					
BOD ₅ ⁽⁶⁾	5mg/L	1L plastic	cool 4°C	4 hours	7 days
Total ammonia	0.005mg/L	250mL plastic	2mL sulphuric acid, cool 4°C	28 days	-
Nitrate	0.005mg/L	500mL plastic	cool 4°C	48 hours	7 days
Nitrite	0.002mg/L	500mL plastic	cool 4°C	48 hours	7 days
Orthophosphate	0.002mg/L	250mL plastic	cool 4°C	48 hours	7 days
TOC ⁽⁵⁾	0.01mg/L	125 ml, glas, amber	2ml HCl acid	28 days	-
Biological					
Chlorophyll	0.2mg/m ³	1 L amber glass	cool 4°C	72 hours	3 days ⁽⁹⁾
Phenophytin	0.2mg/m ³	1 L amber glass	cool 4°C	72 hours	3 days ⁽⁹⁾
Sub-lethal Toxicity Testing ⁽⁷⁾	N/A	20L plastic tote	cool 4°C	7 days	
Bacterial					
Fecal coliforms	1MPN	125mL sterile plastic or glass	cool 4°C	6hrs	48hrs
Organics					
TPH ⁽²⁾	1.0 mg/L	500mL brown glass ⁽⁶⁾	2mL sulphuric acid	14 days	-
BTEX ⁽³⁾	0.0005 mg/L	100mL two septum vial ⁽⁶⁾	2mL sulphuric acid, cool 4°C	14 days	-

Notes:

1. Sample must be field filtered using a 0.45µm disposable filter and syringe.
2. Total petroleum hydrocarbons.
3. Benzene, toluene, ethyl benzene, xylenes.
4. Total suspended solids.
5. Total organic carbon.
6. Zero sample headspace.
7. Type of test organism selected will depend upon objectives of testing.
8. Biochemical oxygen demand - 5 day test.
9. For samples with pH >7, the sample may be preserved by filtering through a glass fibre filter and storing the filter and residue in an airtight plastic bag in a freezer for up to 3 weeks.

Rev. 1 - Issued for 2008 Field Season



TABLE 2.2

BAFFINLAND IRON MINES CORPORATION
MARY RIVER PROJECT

SURFACE WATER SAMPLING PROGRAM - QUALITY ASSURANCE AND QUALITY CONTROL PLAN

SUMMARY OF RECOMMENDED FIELD QA/QC WATER SAMPLES

QA/QC Sample	Purpose	Description	Frequency	Prepared By
Field blank	Identification of potential contaminants arising from sample collection. The field blank bottle is prefilled with laboratory deionized water and is handled in the same way as regular sample bottles (i.e., opened and closed during sample collection). The bottle is submitted as a routine sample.	Bottle contains prefilled deionized water. Bottle is handled the same as one would handle regular samples.	Ten percent of all samples collected will be QA/QC.	Field staff
Travel blank	Identification of potential contaminants arising from sample storage, shipping and laboratory handling. The travel blank accompanies the samples to the laboratory but is not taken out into the field, or opened.	Sealed bottle containing deionized water provided by analytical laboratory	Ten percent of all samples collected will be QA/QC.	Analytical laboratory
Field duplicate	Assesses sample variability and precision of laboratory analytical methods	Duplicate sample selected at random.	Ten percent of all samples collected will be QA/QC.	Field staff

Rev. 2 - Issued for 2009 Field Season

APPENDIX A

***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)***

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

JULY 1996

**DEPARTMENT OF INDIAN AND NORTHERN AFFAIRS CANADA
WATER RESOURCES DIVISION
AND THE
NORTHWEST TERRITORIES WATER BOARD**

Table of Contents

1.0	Introduction and Definitions	1
2.0	Sample Collection	1
2.1	Location	2
2.2	Sampling Equipment	2
2.3	Sampling Methods	3
3.0	Sample Handling	3
3.1	Preservation	3
3.2	Sample Identification	4
3.3	Transportation	4
4.0	Lab Analysis	4
4.1	Lab Accreditation	4
4.2	Detection Limits	5
4.3	Methodology	5
4.4	Reporting Requirements	5
Appendixes		
	Appendix 1	6
	Table 1 - Summary of Preservation Requirements	
	Appendix 2	7
	References	

QA/QC Guidelines - Class "B"

1.0 Introduction and Definitions

The purpose of this guideline is to provide an outline for Licensees to follow when preparing a site-specific Quality Assurance/Quality Control (QA/QC) plan. The QA/QC plan will help ensure that water samples taken in the field maintain a high degree of quality, so that they accurately reflect the physical and chemical nature of the water being tested.

This guideline is divided into three sections:

- 1) Sample Collection
- 2) Sample Handling
- 3) Lab Analysis

It is recognized that there may be different interpretations as to what is covered by "Quality Assurance/Control" due to the fact that certain Licensees have their own laboratories, while others only use commercial laboratories. For licence purposes, "Quality Assurance" and "Quality Control" refer to the following:

Quality Assurance: is the system of activities designed to better ensure that quality control is done effectively; while

Quality Control: is the use of established procedures to achieve standards of measurement for the three principal components of quality: precision, accuracy and reliability.

2.0 Sample Collection

2.1 Location

A QA/QC plan must identify the locations of all sampling stations and the markers used to identify the stations. If the Surveillance Network Program (SNP) of the Water Licence does not specify sampling locations, locations should be chosen with help from an Inspector.

Buoys and landmarks identify sampling stations in tailings ponds and lakes, while sign post positioning usually marks stream sample stations. Stations should be

QA/QC Guidelines - Class "B"

used repeatedly, with the same personnel and techniques to reduce operational error. The use of Global Positioning System (GPS) to identify Latitude and Longitude for sampling stations is recommended.

2.2 Sampling Equipment

The Plan must include a detailed section on the equipment used for sampling and the rationale behind the choices of equipment. Equipment and bottles should be selected so that they do not contaminate or otherwise alter the concentrations of parameters of interest.

Sampling devices, sample bottles and filtration devices should be constructed of non-metallic material. Most samples are now collected in containers constructed of high density polyethylene plastic. However, there are some exceptions, when testing for oil and grease or phenols glass containers are to be used. When conducting a fish bioassay, plastic drums are used while hydrocarbon based containers are not to be used for the collection of organic samples.

This section should also identify whether new or used bottles are used for each sample analysis. New bottles are preferred, but sample containers may be used repeatedly with proper handling measures.

If old bottles are used, a detailed description should be included, noting how they are maintained, stored and cleaned. Usually, this will closely resemble the product manufacturer's instructions. An example of how bottles should be cleaned is outlined below:

- Rinse well with hot tap water for one minute or more.
- Empty bottle and add 30% HNO₃ to approximately 1/3 container capacity. Shake well for three to four minutes.
- Rinse vigorously with hot tap water for two minutes.
- Rinse thoroughly three times with tap water and three times with distilled water.
- Store with 0.2% HNO₃ for a minimum of one week.
- Rinse again with distilled water at least three times.

Bottles that are to be used for bacteria testing should be acid washed or autoclaved if possible.

Note: Additional information on bottle washing is also available from Water

QA/QC Guidelines - Class "B"

Resources Division.

2.3 Sampling Methods

This Section will include details on how the samples are collected and the equipment that is to be used for each section.

In lakes and ponds, regular sample bottles are used the majority of the time, but Van Dorn samples are often utilized. The sample or the sample bottle is usually lowered to mid depth and washed three times before collecting the sample on the fourth submersion. Approximately 2% of the sample container capacity should remain to provide for mixing, preservative addition and thermal expansion.

Stream water sampling is usually done by plunging a sample bottle toward the current and allowing it to fill. Once again, the bottle should be rinsed three times before filling and room should be left for preservative addition and mixing.

A glass bottle should be used when sampling for oil and grease with the sample being collected during the first submersion and not rinsed three times first.

This section should also describe how often field blanks and replicate samples are to be collected. Field blanks are samples of distilled/deionized water that are to be treated in exactly the same manner as the other samples. Blanks should therefore be taken to the field and handled and preserved as part of the sample program. They indicate when a sample may be contaminated and are indicative of general sample integrity. Replicate samples (duplicates and triplicates) are two or three samples collected from the same station at the same time. They help to ensure sample precision at the laboratory.

3.0 Sample Handling

3.1 Preservation

After collection, most samples must be preserved in order to prevent chemical or biochemical changes to the sample. The QA/QC plan must describe how samples from each station are to be preserved.

QA/QC Guidelines - Class "B"

Preservation is generally done by the addition of certain chemicals into the bottle immediately after the sample is collected. Table 1 is a general guide to preservatives and their appropriate concentrations. The QA/QC plan should contain more detailed information on the concentrations and amount of preservatives that will be used.

3.2 Sample Identification

The plan should include a description of the system used to identify samples. The system must provide positive sample identification and ensure that the identification is maintained. It is advisable to keep a logbook of samples that have already been delivered.

The identification can be maintained by marking the bottle itself or a label, with a water resistant, non-smear felt pen. The information should be clear to persons uninvolved in the sampling and may include such details as company name, sample area, SNP number, time and date.

3.3 Transportation

The section on transportation will describe how sample integrity will be ensured from the time of collection to completion of delivery. Delivery to the lab should be done as soon as possible after the samples have been collected.

Usually, samples are sealed and stored upright in a box with other samples to provide a snug, immobile storage space during transfer. Any samples that require refrigeration for preservation should be kept cool during transport.

4.0 Lab Analysis

4.1 Lab Accreditation

The Licensee will identify in the plan the name of the commercial laboratory that will be conducting the analyses. A letter must be provided from the commercial lab indicating that they are accredited to conduct analyses on each of the required sampling parameters. Ideally, the lab should be accredited by the Canadian Associated for Environmental Analytical Laboratories (C.A.E.A.L.) and should

QA/QC Guidelines - Class "B"

provide a certificate stating parameters for which they are accredited.

4.2 Detection Limits

Detection limits for the commercial lab should be identified for all parameters and should be reported when any SNP data is submitted.

4.3 Methodology

Descriptions should be included for any methods of analysis used that are not outlined in "Standard Methods for the Examination of Water and Wastewater".

4.4 Reporting Requirements

The Licensee shall outline the number of replicate samples that will be collected and submitted with each SNP report. It is recommended that one set of duplicates or triplicates from an assigned SNP site, as well as the results from field blanks, be submitted with each required SNP report. These will serve as an internal/external check for the Licensee and the commercial lab.

FOR FURTHER INFORMATION, CONTACT THE WATER RESOURCES DIVISION AT:

**Box 1500
Yellowknife, NWT
X1A 2R3
(403)669-2651 Phone
(403)669-2716 Fax**

Appendix 1

Table 1: General Summary of Special Sampling or Handling Techniques

Determination	Container	Minimum Sample Size (ml)	Preservation	Maximum Storage Recommended
BOD	Sterile polyethylene	1000	Refrigerate 4°C	24 hours
Conductivity	Polyethylene	500	Refrigerate 4°C	28 days
Total Cyanide	Polyethylene	500	Add NaOH to raise pH > 12 refrigerate in dark	24 hours
Hardness	Polyethylene	100	Add Conc. HNO ₃ to lower pH < 2 OR (*) unpreserved	6 months
Metals, General	Polyethylene	250	For dissolved metals filter immediately, add Conc. HNO ₃ to pH < 2	6 months
Mercury	Glass (rinsed with 1 + 1 HNO ₃)	500	Add Conc. HNO ₃ or pH < 2 or H ₂ SO ₄ + 1 ml of 5% K ₂ Cr ₂ O ₇ , refrigerate 4°C	28 days
Nitrogen				
Ammonia	Polyethylene	500	Analyze as soon as possible or add H ₂ SO ₄ to pH < 2, refrigerate OR (*) unpreserved	7 days
Nitrate	Polyethylene	100	Analyze as soon as possible or refrigerate	48 hours
Oil and Grease	Glass or wide-mouth calibrated	1000	Add H ₂ SO ₄ to pH < 2, refrigerate	28 days
pH	Polyethylene	—	Analyze immediately	2 hours
Suspended Solids	Polyethylene	—	Refrigerate	7 days
Temperature	Polyethylene	—	Analyze immediately	0
Turbidity	Polyethylene	—	Analyze same day; store in dark up to 24 hours, refrigerate	24 hours
Bacteria	Polyethylene (sterilized)	—	None; Keep cool	6 - 48 hours

(*) Unpreserved = check with lab that will be analyzing the samples

QA/QC Guidelines - Class "B"

Appendix 2

References:

Gilbert, Andrew (1993). "Echo Bay Mines Ltd. Environmental Laboratory Quality Assurance Plan".

Soniassy, R. (1980). "A Guide for the Collection of Water and Effluent Samples"; pp 1-16; INAC

"Standard Methods for the Examination of Water and Wastewater" (1989); AHPA, AWWA and WPCF, 17th edition.

Water Resources Division, Indian and Northern Affairs Canada (1990). "Generic Quality Assurance (QA) Plan Guidelines for Use by the Licensees in Meeting SNP Requirements for Submission of a QA Plan"; INAC.

APPENDIX B

EXAMPLE FORMS

Sample Chain of Custody - 1 page
Record of Water Sample Field Parameter Measurements - 1 page
Field Monitoring Data Form - 1 page
Analytical Request Form - 1 page
Chain of Custody Record - 1 page

BAFFINLAND MARY RIVER PROJECT

SAMPLE CHAIN OF CUSTODY

FROM: _____

TO: _____

F.A.O. _____

Note:

No.	Sample I.D.	Sampling Date	Sampler	Sample Type	Sample Filtered?	No. of Bottles	Rush?	Analyses																	
								General Chemistry								Nutrients					Bacterial	Organics			
								Metals	Arsenic	Mercury	Anions	TSS	pH	Conductivity	Total Hardness	Total Alkalinity / Acidity	BOD ₅	Total ammonia	Nitrate	Nitrite	Orthophosphate	TOC	Faecal coliforms	TPH	BTEX
1																									
2																									
3																									
4																									
5																									
6																									
7																									
8																									
9																									
10																									
11																									
12																									
13																									
14																									
15																									
16																									
17																									
18																									
19																									
20																									

BAFFINLAND MARY RIVER PROJECT

Record of Water Sample Field Parameter Measurements

No.	Sample I.D.	Sampling Date	Sampler	Field Parameters						Notes
				pH	Temperature (°C)	Conductivity (mS)	Redox (mV)	D.O. (mg/L)		
								mg/L	%	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										
16										
17										
18										
19										
20										

DATE AND TIME: _____

FIELD MONITORING DATA FORM

STATION ID: _____

Environmental Department office – 519-397-9092

Site Information

Coordinates: Northing (m): _____ Easting (m): _____ Zone: _____ Datum: _____

Climate: Temp. (°C): _____ Precipitation: _____ Cloud cover (%): _____

Wind speed (kn): _____ Wind direction: _____ Wave height (m): _____

Description: _____

Field Data

Water Quality Meter: _____ Last Calibration: _____

Snow Depth (m): _____ Freeboard (m): _____ Ice Thickness (m): _____ Water Depth (m): _____

No.	Depth (m)	Temp. (°C)	pH		(mg/L)	DO		SpC (µS/cm)	Cond. (µS/cm)	Sal.	TDS (g/L)
			(units)	(mV)		(%)	(ch)				
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											
21											
22											
23											
24											
25											
26											
27											
28											
29											
30											

Samples Information

Potable Water	Wastewater	Surface Water
<input type="checkbox"/> Baffinland DW Micro <input type="checkbox"/> Baffinland DW Chem <input type="checkbox"/> Baffinland DW Metals <input type="checkbox"/> Baffinland DW THMs	<input type="checkbox"/> Baffinland WW Micro <input type="checkbox"/> Baffinland WW Chem <input type="checkbox"/> Baffinland WW O&G Tot.	<input type="checkbox"/> Baffinland SW Micro <input type="checkbox"/> Baffinland SW Chem <input type="checkbox"/> Baffinland SW Metals <input type="checkbox"/> Baffinland SW BTE <input type="checkbox"/> Baffinland SW O&G Tot.

Comments: _____

TECHNICIAN (please print): _____ SIGNOFF: _____



TAIGA ENVIRONMENTAL LABORATORY LABORATOIRE ENVIRONNEMENTAL TAIGA

4601 – 52 Avenue, P.O. Box 1500, Yellowknife, NT, X1A 2R3

Tel: (867) 669-2788 • Fax: (867) 669-2718

www.taiga.gc.ca

Analytical Request Form

Page 1 of 1

REPORT TO : <u>Company/Client ID :</u> <u>Address :</u> <u>Attention :</u> <u>Phone :</u> <u>Fax :</u> <u>e-mail :</u> e-mail ¹ Fax ¹ Mail ¹			INVOICE TO : SAME Y / N Company : (no charge) Address : _____ Attention : _____ Phone : _____ Fax : _____ e-mail : _____ e-mail ¹ Fax ¹ Mail ¹			INFORMATION TO BE INCLUDED ON REPORT & INVOICE: Quotation No : _____ Client Project No : _____ Sampler : _____ Relinquished By : _____ Signature : _____ Date : _____																		
SERVICE REQUESTED: Regular Service ¹ Rush Service ¹ <i>(Surcharge applies to rush service, please check with Laboratory for price and availability)</i> Note: Analysis may be subcontracted without prior notice.			Sample(s) are from a Drinking Water source servicing multiple households Yes ¹			<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th colspan="6">Analysis Requested</th> <th rowspan="2" style="writing-mode: vertical-rl; transform: rotate(180deg);">No. of Containers</th> </tr> <tr> <td></td><td></td><td></td><td></td><td></td><td></td> </tr> </table>						Analysis Requested						No. of Containers						
Analysis Requested						No. of Containers																		
	TAIGA Sample ID <small>(Laboratory use only)</small>	Client Sample ID	Location	<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <th colspan="2">Collected</th> </tr> <tr> <th>Date</th> <th>Time</th> </tr> </table>		Collected		Date	Time	Sample Type														
Collected																								
Date	Time																							
1																								
2																								
3																								
4																								
5																								
6																								
7																								
8																								
9																								
10																								
For water samples, please indicate if sample container was filtered (F) and/or preserved (P).																								
Date Received : _____ Time Received : _____ Received By : _____			Sample(s) state at receipt: Temperature: _____ °C Frozen ¹ Comments : _____ _____				Hazardous material? Y / N Highly Contaminated? Y / N																	

ACCUTEST LABORATORIES LTD.

☐ 146 Colonnade Rd., Unit 8
 Ottawa, ON K2E 7Y1
 Ph: (613) 727-5692 Fax: (613) 727-5222

CHAIN OF CUSTODY RECORD

☐ 608 Norris Court
Kingston, ON K7P 2R9
Ph: (613) 634-9307 Fax: (613) 634-9308

LABORATORY USE ONLY

Report #:

Company Name:	Address:	<input type="checkbox"/> Fax Results to: _____ <input type="checkbox"/> E-mail Results to: _____ <input type="checkbox"/> Copy of Results to: _____
Report Attention:	City/Prov: Postal Code:	
Phone: Ext	Project # * Quotation #	
* Waterworks Name:	* Waterworks Number:	<i>Note that for drinking water samples, all exceedances will be reported where applicable legislation requires.</i>

Invoice to:
(if different from above)

SAMPLE ANALYSIS REQUIRED

⇨ Indicate: F=Filtered or P=Preserved

[illegible]

Sample Type Codes for Drinking Water Systems: **RW** = Raw Water, **RWFC** = Raw Water For Consumption, **TW** = Treated Water at point of entry to distribution, **DW** = Distribution/Plumbing Water
 "MOE Reportable" refers to the requirements under the SDWA for immediate reporting of results, which are indicators of adverse water quality, to the Owner/Operator, MOE, and MOH Medical Officer.

Sampled By:		Date/Time:	Relinquished By:	Date/Time:	Comments	Cooler Temp (°C) on Receipt
Work Authorized By (signature):		Date/Time:	Received By Lab:	Date/Time:		
<p>* Indicates a required field. If not complete, analysis will proceed only on verification of missing information. A quotation number is required, if one was provided.</p> <p>** There may surcharges applied to "Rush" service. Please check with lab prior to submission of samples for rush analysis to confirm availability and pricing.</p>						

APPENDIX C

ANALYTICAL LABORATORY ACCREDITATION

ALS Laboratory Group - 2 pages
Accutest Laboratories - 2 pages
Aquatox Testing & Consulting Inc. - 2 pages

ALS LABORATORY GROUP



**National
Quality Manual**

Document ID: NAQM1 v02 Quality Manual

Date: September 7, 2007

Page: 3 of 29

1.0 SCOPE

This Quality Manual describes the Quality Management System of the ALS Laboratory Group Environmental Division locations in Canada. Where appropriate, it refers to other documents for additional information. Throughout this manual, whenever ALS is used alone, it refers to the Environmental Division of the ALS Laboratory Group in Canada.

2.0 LOCATIONS, ACCREDITATIONS AND RECOGNITIONS

ALS has laboratories across Canada. Addresses and contact information are available by following the links at our web site: www.alsenviro.com.

Labs within our network are accredited or recognized by the following agencies, as appropriate to their fields of testing and geographical sectors.

- Canadian Association for Environmental Analytical Laboratories (CAEAL) – www.caeal.ca
- Standards Council of Canada (SCC) – www.scc.ca
- American Industrial Hygiene Association (AIHA) – IHLAP - www.aiha.org
- American Industrial Hygiene Association (AIHA) – EMLAP – www.aiha.org
- State of Washington Department of Ecology (WADOE) – www.ecy.wa.gov
- United States National Environmental Laboratory Accreditation Program (NELAP) - www.nj.gov/dep/oqa
- British Columbia Provincial Health Officer – EWQA – www.pathology.ubc.ca
- British Columbia Ministry of Environment – EDQA – www.env.gov.bc.ca
- Ontario Ministry of Environment – www.ene.gov.on.ca
- Health Canada Good Manufacturing Practices (GMP) - Establishment License - www.hc-sc.gc.ca

Copies of current certificates and licenses applicable to these programs are available on www.alsenviro.com. Scopes of accreditation and/or program information are available on the web sites linked above.

3.0 TERMS AND DEFINITIONS

The terms and definitions relevant to the national quality management system are described in a nationally controlled file. For instances where local and national documents describe similar terms and definitions, the local document takes precedence.

Refer to:

- Local Master List: DEFINITIONS OF KEY TERMS

ACCUTEST LABORATORIES

Methods of Quality Control

The objective of the Quality Assurance Program is to ensure that results provided by the laboratory to our clients or regulatory bodies are accurate and precise, as well as consistent over time. Various techniques; statistical, investigative, preventative, administrative, and corrective will be utilized to maximize the reliability of the data.

The analytical services provided by Accutest Laboratories are based on industry recognized methodologies published by the following:

- AWWA, APHA - "Standard Methods for the Examination of Water and Wastewater", 20th Edition, 1998.
- Ontario Ministry of Agriculture, Food, and Rural Affairs
- Ontario Ministry of the Environment
- ASTM - American Society for Testing Materials
- AOAC "Official Methods of Analysis"
- CCME
- USEPA 500, 600, and SW846 Series Methodologies, and
- other recognized regulatory and industry sources

Certification and Accreditation

Accutest maintains a rigorous program of certification and accreditation from several governing sources. In 1989 the laboratory received accreditation from the Ontario Ministry of Agriculture, Food, and Rural Affairs (**OMAFRA**) to provide analysis of farm soil for the agricultural community.

In 1991 the laboratory received certification from the Canadian Association of Environmental Analytical Laboratories (**CAEAL**), Registration Number 2602. The Kingston laboratory's registration number is 2970. In 1995, following an independent laboratory audit by CAEAL, under the direction of the Standards Council of Canada (**SCC**), Accutest achieved full accreditation for specific parameters to **ISO 17025** criteria (Registration Number 164).

For up to date accreditation details, the SCC's web site can be found at: www.scc.ca

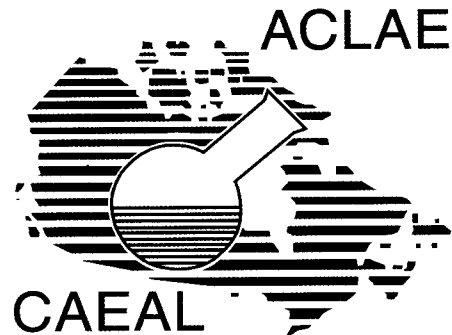
CAEAL's web site is: www.caeal.ca

Accutest is a Ministry of Transportation for Ontario (**MTO**) approved laboratory for the analysis of chloride content in concrete.

Interlaboratory Studies

Accutest regularly takes part in interlaboratory studies. As part of the accreditation programs of both CAEAL/SCC and OMAFRA, the performance of Accutest is monitored through the analysis of unknown quality control samples submitted by an external agency.

AQUATOX TESTING & CONSULTING INC.



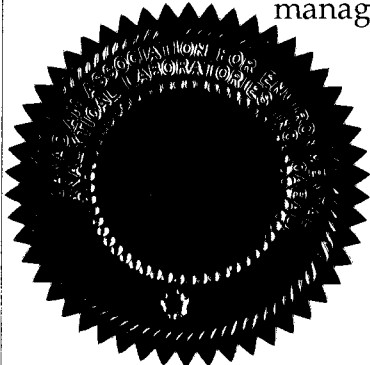
Canadian Association for Environmental Analytical Laboratories Inc.

Certificate of Accreditation

AquaTox Testing & Consulting Inc.
11B Nicholas Beaver Road, RR#3
Guelph, Ontario

COPY

This laboratory is accredited in accordance with the recognised International Standard ISO/IEC 17025:2005. This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer joint ISO-ILAC-IAF Communiqué dated 18 June 2005).



Accreditation No. A2803

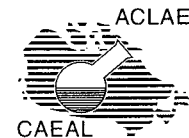
Accreditation Date January 3, 2005

Issued on March 14, 2007

Expiry Date March 14, 2010

A handwritten signature in black ink, likely of the Chief Executive Officer.

Chief Executive Officer



This certificate is the property of Canadian Association for Environmental Analytical Laboratories Inc. and must be returned on request; reproduction must follow guidelines in place at date of issue. For the specific tests to which this accreditation applies, please refer to the laboratory's scope of accreditation at www.caeal.ca.

APPENDIX D

LABORATORY ANALYTICAL METHODS

ALS Laboratory Group - 3 pages
Accutest Laboratories - 3 pages
Taiga Environmental Laboratory - 9 pages
Aquatox Testing & Consulting Inc. - 3 pages

ALS LABORATORY GROUP



**National
Quality Manual**

Document ID: NAQM1 v02 Quality Manual

Date: September 7, 2007

Page: 21 of 29

5.4 TEST METHODS AND METHOD VALIDATION

5.4.1 General

All ALS locations use appropriate methods for all tests performed, including those for estimating uncertainty and statistical techniques for analyzing data. Test methods are documented and include all instructions needed to operate equipment and protect the integrity of samples and analytical results. Test method instructions and support information is kept current and accessible where needed.

Deviations from test methods occur only if the deviation has been documented, technically justified, authorized, and accepted by the customer where applicable. Analytical department supervisors and managers have the authority to approve method deviations for the analysis of samples and to impose appropriate quality control into the analysis. If the deviation is judged to alter the outcome of a test, client acceptance of the deviation will be obtained prior to approval. Documentation follows the same requirements as for data quality and method objective -refer to section 4.9

5.4.2 Selection of Methods

Customers rely on ALS to select test methods that are appropriate to meet their needs and are appropriate for the tests performed. ALS uses the latest versions of published standard methods developed by organizations such as American Public Health Association, United States Environmental Protection Agency, NIOSH, Environment Canada, and other international, regional or regulatory organizations or equipment manufacturers whenever possible. When needed, the standard method will be supplemented with additional instructions to ensure consistency of application and performance. Where an appropriate standard method is not available ALS may develop and validate an in-house test method, or adopt a third party validated method. ALS provides method information to clients upon request and on test reports.

For published reference methods, each ALS location confirms it can properly operate the standard method before introducing the test into the laboratory. If the standard method changes in a manner that may affect test results, the confirmation is repeated.

Unique circumstances may occur where a customer specifies the methodology to be used. The customer will be notified if ALS deems the recommended method is inappropriate or out of date.

5.4.3 Laboratory Developed Methods

When in-house development of a test procedure is needed, qualified individuals are assigned to the planning and development stages of the project. The plan is updated as development progresses and all changes are effectively communicated among all involved.

5.4.4 Non-standard Methods

If it is necessary to use methods not covered by standard methods, customer agreement will be obtained and will include clear specification of their requirements and the purpose of the test. The developed method will be appropriately validated before use.



**National
Quality Manual**

Document ID: NAQM1 v02 Quality Manual

Date: September 7, 2007

Page: 22 of 29

5.4.5 Validation of Methods

Method validations are conducted to confirm that the methods are fit for their intended use. The validations are as extensive as necessary to meet the needs of the given application. The extent depends on the source of the method. For example, standard methods used for their intended application require a less extensive validation than non-standard methods or standard methods used outside of their intended scope.

All results relating to the validation of a given method, including the procedure used for validation and a statement of whether the method is fit for the intended use are retained in method validation records.

As appropriate, the validation studies performed will verify the range and accuracy of the results obtained, including uncertainty, detection limit, selectivity of the method, linearity, repeatability and/or reproducibility, robustness and/or sensitivity to interference. Measurement uncertainty values are reviewed to ensure they are sufficient to meet customers needs.

5.4.6 Estimation of Measurement Uncertainty

ALS has procedures for estimating measurement uncertainty. The procedures are based on accepted practices of identifying components contributing to uncertainty, compiling data that represents or includes these components, evaluating the data using appropriate statistical calculations, and reporting in a manner that prevents misunderstanding of the result. In those cases where the nature of the test precludes calculation of uncertainty, ALS will at minimum identify the components of uncertainty and make a reasonable estimation where needed. This estimation will be based on knowledge of the performance of the method and validation data.

5.4.7 Control of Data

Automated calculations and data transfer systems are checked in a systematic manner when first programmed and re-verified appropriately when changes are made.

When computers and automated equipment are used for the acquisition, processing, recording, reporting, storage or retrieval of test data, ALS ensures:

- in-house developed software is sufficiently documented and validated
- procedures are implemented for protecting data, including integrity and confidentiality of entry, collection, storage transmission and processing – refer to sections 4.13, 5.1 and 5.10
- computers and automated equipment are maintained to ensure proper functioning and adequate environmental conditions – refer to section 5.1

Refer to:

- Local Master List: METHOD VALIDATION
- Local Master List: LIMS CALCULATIONS AND DATA TRANSFERS
- Local Master List: SOFTWARE DEVELOPED IN-HOUSE

ACCUTEST LABORATORIES

Details of Quotation

BOD5

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
BOD5	BOD5 - AMBODEE1 SM 5210B	1	mg/L

Chlorophyll/Pheophytin

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
Chlorophyll-a	Chlorophyll C SM10200H	0.2	mg/m3
Pheophytin-a	Chlorophyll C SM10200H	0.2	mg/m3

Knight P - SW (no metals)

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
pH	pH in water : Auto - AMAPCAE1 C SM4500-H+B	1	
Conductivity	Conductivity : Auto - AMAPCAE1 C SM2510B	5	uS/cm
Alkalinity as CaCO3	Alkalinity : Auto - AMAPCAE1 SM 2320B	5	mg/L
TDS (COND - CALC)	solids in water - AMSOLWE1 C SM2540	5	mg/L
Turbidity	Turbidity - AMTURBE1 C SM2130B	0.1	NTU
Phenols	Phenols 4-AAP - AMPHACE1 C SM5530D	0.001	mg/L
N-NH3	NH3 water low - AMNH3LE1 C SM4500-NH3D	0.02	mg/L
SO4	Anions by IC - DX-100 SM 4110C	1	mg/L
Cl	Anions by IC - DX-100 SM 4110C	1	mg/L
Br	Anions by IC - DX-100 SM 4110C	0.05	mg/L
N-NO2	Low NO2 - SKALAR C SM4500-NO2-B	0.005	mg/L
N-NO3	NO2/NO3 SKALAR - AMNOXSE1 C SM4500-NO3-F	0.1	mg/L
NO2 + NO3 as N	NO2/NO3 SKALAR - AMNOXSE1 C SM4500-NO3-F	0.1	mg/L
TOC	DOC/TOC in water Combustion C SM5310B	0.5	mg/L
DOC	DOC/TOC in water Combustion C SM5310B	0.5	mg/L
Total Suspended Solids	solids in water - AMSOLWE1 C SM2540	2	mg/L
Total P	Low Total P C SM4500-PF	0.003	mg/L
Total Kjeldahl Nitrogen	TKN low water - AMTKNLE1 C SM4500-Norg-C	0.1	mg/L

Reg 170 - Schedule 23

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
Ba	ICP-MS PE6100 EPA 200.8	0.01	mg/L
B	ICP-MS PE6100 EPA 200.8	0.01	mg/L
Cd	ICP-MS PE6100 EPA 200.8	0.0001	mg/L
Cr	ICP-MS PE6100 EPA 200.8	0.001	mg/L
As	ICP-MS PE6100 EPA 200.8	0.001	mg/L
Se	ICP-MS PE6100 EPA 200.8	0.001	mg/L
Sb	ICP-MS PE6100 EPA 200.8	0.001	mg/L
Hg	Hg in water - AMHGCTE1 M SM3112B-3500B	0.0001	mg/L
U	ICP-MS PE6100 EPA 200.8	0.001	mg/L

SUBDIV. BACTI

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
Total Coliforms	Bacteria - AMBCOLM1 SM 9222B	0	ct/100mL
Faecal Coliforms	Bacteria - AMBCOLM1 SM 9222B	0	ct/100mL

Details of Quotation

Faecal Streptococcus	Bacteria - AMBCOLM1 SM 9222B	0	ct/100mL
Escherichia Coli	Bacteria - AMBCOLM1 SM 9222B	0	ct/100mL
Heterotrophic Plate Count	SPC - AMBCOLM1 SM9215D	0	ct/1mL

SUBDIV. SUPPLY NO BACTI

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
Fe	ICP-MS PE6100 EPA 200.8	0.03	mg/L
Mn	ICP-MS PE6100 EPA 200.8	0.01	mg/L
Hardness as CaCO ₃	Alkalis by FAA - AMAMFAE1 SM 3111B-3500B	5	mg/L
Alkalinity as CaCO ₃	Alkalinity : Auto - AMAPCAE1 SM 2320B	5	mg/L
pH	pH in water : Auto - AMAPCAE1 C SM4500-H+B	1	
Conductivity	Conductivity : Auto - AMAPCAE1 C SM2510B	5	uS/cm
F	F Autotitrator C SM4500-FC	0.1	mg/L
Na	ICP metals - AMMICPE8 M SM3120B-3500C	2	mg/L
N-NO ₃	NO ₂ /NO ₃ SKALAR - AMNOXSE1 C SM4500-NO ₃ -F	0.1	mg/L
N-NO ₂	NO ₂ /NO ₃ SKALAR - AMNOXSE1 C SM4500-NO ₃ -F	0.1	mg/L
N-NH ₃	NH ₃ water low - AMNH3LE1 C SM4500-NH ₃ D	0.02	mg/L
SO ₄	Anions by IC - DX-100 SM 4110C	1	mg/L
Cl	Anions by IC - DX-100 SM 4110C	1	mg/L
Phenols	Phenols 4-AAP - AMPHACE1 C SM5530D	0.001	mg/L
Turbidity	Turbidity - AMTURBE1 C SM2130B	0.1	NTU
Colour	Colour - AMCOLSE1 C SM2120C	2	TCU
Ca	ICP metals - AMMICPE8 M SM3120B-3500C	1	mg/L
Mg	ICP metals - AMMICPE8 M SM3120B-3500C	1	mg/L
Tannin & Lignin	Tannin & Lignin - AMTNLNE1 C SM5550B	0.1	mg/L
Total Kjeldahl Nitrogen	TKN low water - AMTKNLE1 C SM4500-Norg-C	0.1	mg/L
K	ICP metals - AMMICPE8 M SM3120B-3500C	1	mg/L
DOC	DOC/TOC in water Combustion C SM5310B	0.5	mg/L
H ₂ S	H ₂ S water - AMH2SCE1 C SM4500-S ₂ -D	0.01	mg/L
Ion Balance	Ion Balance C Ion Balance	0.01	
TDS (COND - CALC)	solids in water - AMSOLWE1 C SM2540	5	mg/L

TSS

<u>ANALYTE</u>	<u>METHOD REFERENCE</u>	<u>MDL</u>	<u>UNITS</u>
Total Suspended Solids	solids in water - AMSOLWE1 C SM2540	2	mg/L

AQUATOX TESTING & CONSULTING INC.



AquaTox Testing & Consulting Inc.
11B Nicholas Beaver Rd.
RR 3
Guelph ON N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419

To: Cheryl Wray
Company: Baffinland Iron Ore
Date: October 15, 2007
File: 162704515

From: Lesley Novak, M.Sc.
☐ For Your Information
☐ For Your Approval
☐ For Your Review
☒ As Requested

Reference: Toxicity Testing Services

I am pleased to provide you with a quotation for toxicity testing services for wastewater effluent monitoring (Table 1).

AquaTox's laboratory is accredited for all of the tests listed in Table 1. A copy of our SCC/CAEAL Certificate of Accreditation along with our scope of testing (which lists all of the specific tests that we are currently accredited for) can be provided at your request.

We appreciate your past support and look forward to a continued association. Please call me if you have any questions or require additional information.

AquaTox Testing & Consulting Inc.

A handwritten signature in black ink that reads "Lesley Novak". The signature is written in a cursive, flowing style.

Lesley Novak, M.Sc.
Vice President, Senior Aquatic Toxicologist
Tel: 519-763-4412
Fax: 519-763-4419
lnovak@aquatox.ca



AquaTox Testing & Consulting Inc.
11B Nicholas Beaver Rd.
RR 3
Guelph ON N1H 6H9
Tel: (519) 763-4412 Fax: (519) 763-4419

QUOTATION NO.: 162704515

CLIENT: Cheryl Wray
Baffinland Iron Ore
cheryl.wray@baffinland.com

PERIOD: October 15th to December 31st, 2008

DESCRIPTION: Toxicity Testing Services

Table 1. Summary of toxicity testing costs.

Test	Method	Unit Cost
48-h single concentration test using <i>Daphnia magna</i>	EPS 1/RM/14	\$165
96-h single concentration test using rainbow trout	EPS 1/RM/13	\$220
48-h multiple concentration (LC50) test using <i>Daphnia magna</i>	EPS 1/RM/14	\$260
96-h multiple concentration (LC50) test using rainbow trout	EPS 1/RM/13	\$385

TERMS AND CONDITIONS:

- Costs do not include collection or transportation of samples to our laboratory.
- Costs are based on turnaround of 15 business days from completion of test.
- Cost excludes applicable taxes (e.g., G.S.T., P.S.T.).
- Toxicity testing services to be provided on an as needed basis.
- AquaTox will provide all sampling materials including pails, lids, liners, coolers, sample bottles, self-adhesive return labels and chain-of-custody forms for all samples (at no additional cost).
- Limitation of Liability: The CLIENT (Baffinland Iron Ore) releases AquaTox Testing & Consulting Inc. (AquaTox) from any liability and agrees to defend, indemnify and hold AquaTox harmless from any and all claims, damages, losses, and/or expenses, direct and indirect, or consequential damages, including but not limited to lawyer's fees and charges and court and arbitration costs, arising out of, or claimed to arise out of, the performance of the services, excepting liability arising from the sole negligence of AquaTox. It is further agreed that the total amount of all claims the CLIENT may have against Aquatox under these Terms and Conditions, including but not limited to claims for negligence, negligent misrepresentation and breach of contract, shall be strictly limited to the lesser of professional fees paid to AquaTox for the services or five hundred thousand dollars (\$500,000). No claim may be brought against AquaTox more than two (2) years after the cause of action arose. As the CLIENT's sole and exclusive remedy under these Terms and Conditions any claim, demand or suit shall be directed and/or asserted only against AquaTox and not against any of AquaTox's employees, officers or directors.
- Submission of samples assumes acceptance of these Terms and Conditions

APPENDIX E

ANALYTICAL LABORATORY QA/QC PROCEDURES

ALS Laboratory Group - 4 pages
Accutest Laboratories - 2 pages
Aquatox Testing & Consulting Inc. - 3 pages

ALS LABORATORY GROUP



**National
Quality Manual**

Document ID: NAQM1 v02 Quality Manual
Date: September 7, 2007
Page: 26 of 29

Refer to:

- Local Master List (where applicable): FIELD SAMPLING
- Local Master List (where applicable): SUB-SAMPLING

5.8 HANDLING OF SAMPLES

ALS procedures for sample handling include transportation conditions, receipt, handling, protection, storage, retention, and disposal. The procedures are designed to protect the integrity of the test samples and the interests of the customer and ALS.

ALS requests that our customers use our Chain of Custody (COC) for every shipment of samples. The form includes sufficient space to record field sampling date, time and location of sampling, sample ID and information relating to the integrity of the field sample. COCs are shipped with field supplies, and are also available on the alsenviro.com web site.

Samples are given a unique identification upon receipt. The identification is retained by the sample throughout its life in the laboratory, and ensures samples are not confused either physically or in records or reports. Where appropriate, the system allows for subdivision of test items and transfer within and from the laboratory.

Abnormalities or other departures from specified sampling or transportation procedures are documented. Where there is doubt concerning the integrity of the sample, its identification or suitability for testing, or the requested tests, the customer is consulted for further instructions before proceeding, and the discussion is documented.

All ALS locations have appropriate facilities to securely maintain sample integrity, both before testing and where archiving for future testing is required. Sample storage and handling criteria are recorded in individual test methods. Traceability and monitoring of critical temperatures is maintained and discussed in section 5.6.

Refer to:

- Local Master List: SAMPLE RECEIPT AND LOGIN
- Local Master List: SAMPLE STORAGE

5.9 ASSURING THE QUALITY OF TEST RESULTS

ALS has established quality control (QC) procedures for monitoring the validity of tests performed by its laboratories. Individual test methods specify the in-batch quality control requirements, frequency of use and data quality objectives. Where appropriate, in-batch QC is recorded on control charts to detect trends, statistical techniques are used to monitor method performance, and planned action is taken to correct problems and prevent incorrect results from being reported. In-batch QC tools include reference samples, control samples and standards, verification standards, blanks, duplicates, surrogates and spikes as appropriate to the field of testing.



**National
Quality Manual**

Document ID: NAQM1 v02 Quality Manual

Date: September 7, 2007

Page: 27 of 29

ALS laboratories participate in an extensive proficiency testing program where available. Where appropriate proficiency testing samples are not available, other monitoring tools are used.

Samples may be maintained for retesting where the integrity of the test result will not be compromised by the additional storage time.

All test data is reviewed and approved prior to release to the customer. The data review process includes manual transcription review, data-set review, inter-parameter relationship evaluation where appropriate to the tests performed, and report review. Manual transcriptions are reviewed for transcription errors. Data set review is conducted by authorized individuals and includes confirmation that quality control criteria are met and that anomalous data are qualified. Report review confirms that requested tests have been carried out and that all report information and formatting is correct for the specific customer.

Refer to:

- Local Master List: DATA QUALITY AND METHOD OBJECTIVES
- Local Master List: RECHECKS
- Local Master List: CONTROL CHARTS
- Local Master List: RELATIONAL CHECKS
- Local Master List: PROFICIENCY TESTING PROGRAMS
- Local Master List: DATA VALIDATION AND AUTHORIZATION

5.10 REPORTING RESULTS

All information listed below is either included in the final report or kept on file at ALS in the case of abbreviated or customized reports, and can be provided upon request.

- Title
- Name and address of the laboratory issuing the report
- Location where each test was conducted
- Unique identification of the test report on each page, and the total number of pages
- Customer name and address
- Identification of test method(s) used
- Unique identification of each sample, description of the sample such as matrix and customer identification, and condition where applicable
- Date of sample receipt
- Date of analysis
- Test results and units
- Report Qualifiers
- Name, function, and signature of the person authorizing the report
- Statement that the results relate only to the samples identified in the report

Other information necessary for the interpretation of results or requested by the customer may also be included in reports, such as test method deviations or exclusions, specific test conditions, uncertainty estimations, date of sampling, location of sampling and other sampling information.



**National
Quality Manual**

Document ID: NAQM1 v02 Quality Manual
Date: September 7, 2007
Page: 28 of 29

Statements of compliance, opinions and interpretations may be included on test reports for specific analyses. In all such cases, the basis on which they have been made will be documented, and they will be clearly identified in the test report.

ALS obtains subcontract laboratory results in hard or electronic reports. When these results are presented to the customer in ALS reports, the identification of the subcontractor is clearly indicated on the final report.

When test reports are transmitted by telephone, facsimile, e-mail or other electronic means, the procedure for protecting the integrity and confidentiality of data includes:

- only providing results to those individuals specified by the client for each sample submission
- use of a standardized facsimile cover page that relates the procedures to follow if received in error
- use of an e-mail footer that relates the procedures to follow if received in error

It is ALS practice to never disclose information about a client's analysis to a third party without the prior consent of the client, or unless compelled to by law. If we are obligated by law to disclose such information, we will inform the client prior to doing so.

Final results are reported in a manner that minimizes the possibility of misunderstanding or misuse.

Test report amendment(s) are made by issuing a replacement report identifying that a revision was made and describing all changes in the cover page comment section.

Refer to:

- Local Master List: REPORTING TEST RESULTS

6.0 REFERENCES

ISO/IEC 17025:2005(E) General Requirements for the competence of testing and calibration laboratories, Second Edition, 2005-05-15. [L:\Quality System Documents\External Documents\17025 \(E\) 2005.pdf](L:\Quality System Documents\External Documents\17025 (E) 2005.pdf)

Program, policy and guidance documents of the following accreditation bodies:

- Canadian Association for Environmental Analytical Laboratories (CAEAL), located at: www.caeal.ca
- Standards Council of Canada (SCC), located at: www.scc.ca
- American Industrial Hygiene Association (AIHA), located at: www.aiha.org
- National Environmental Laboratory Accreditation Conference (NELAC), located at: www.epa.gov/nelac

ACCUTEST LABORATORIES

In-house QA/QC

Utmost care is taken to provide our clients with analytical data of the highest quality. Accutest maintains several layers of data approval where, at any point in the analytical process, the reviewer has the authority to reject a data set based upon rigid QA/QC protocol. In addition, the following steps are taken during routine analyses, though not limited to:

- reagent blanks/standard reference materials are analyzed within each sample batch
- where appropriate, internal standards and/or spikes are analyzed within each sample batch to verify instrument calibration
- all reagents are prepared from ACS or better grade chemicals
- a minimum of 10% of all samples are analyzed in duplicate
- samples are retained for 2 months after receipt
- all standard, blank, and spike values are catalogued for reference
- travel blanks, field blanks, equipment blanks, and travel spikes are provided on request

Instrumentation

Accutest operates and maintains the following analytical instruments in a high degree of repair and routine calibration for the tests performed:

- Varian Star 3900 Gas Chromatograph, 70-Port Autosampler, Varian 2200 Mass Spectrometer (GC/MS);
- Varian CP-3800 Gas Chromatograph, SOLATek 72-Port Autosampler, Varian 2200 Mass Spectrometer (GC/MS) in parallel with a Flame Ionization Detector (FID);
- Varian CP-3800 Gas Chromatograph, SOLATek 72-Port Autosampler, Varian 2100T Mass Spectrometer (GC/MS) in parallel with a Flame Ionization Detector (FID);
- Agilent 6890N Gas Chromatograph, 7683 Autosampler, 5973 Mass Selective Detector (GC/MS);
- Varian CP-3800 Gas Chromatograph, autosampler with direct injection, Varian 2000 Mass Spectrometer (GC/MS);
- Agilent 6890N Gas Chromatograph, autosampler with dual direct injection, dual FIDs;
- Varian CP-3800 Gas Chromatograph, autosampler with dual FIDs;
- Varian CP-3800 Gas Chromatograph, autosampler direct injection, dual analytical column, dual Electron Capture Detection (GC/ECD);
- Agilent 6890N Gas Chromatograph, autosampler direct injection, dual analytical column, dual Electron Capture Detection (GC/ECD);
- Varian ProStar HPLC with PDA and Fluorescence Detection, 84-Port Autosampler;
- Varian Vista AX ICP/AES;
- Perkin-Elmer Elan 6100 ICP/MS;
- Perkin-Elmer Elan 9000 ICP/MS;
- Atomic Absorption Spectrometers, Hydride Generator, Mercury Analyzer;
- Dionex Ion Chromatographs, Spectrophotometers, TOC Analyzers;
- Automated 56-Port PC-Titrate pH, Alkalinity, Conductivity analyzer; and
- pH and Specific Ion Meters, Turbidity Meter, COD Digestor, Incubators, Digestors, Filtration Apparatus, and Microscopes.

AQUATOX TESTING & CONSULTING INC.

AQUATOX QA/QC PRACTICES RELATED TO TOXICITY TESTING

It is the policy of AquaTox to provide the highest standards of testing service to its clients by conducting tests in accordance with the required methods and client requirements. AquaTox is committed to good professional practice, quality service and compliance with CAN-P-4D.

AquaTox requires that all personnel concerned with testing activities within the laboratory familiarize themselves with the quality documentation and implement the policy and procedures in their work.

The overall QA objective is to develop and implement procedures for chain-of-custody, laboratory analysis and reporting that will provide accurate data. The purpose of the QA/QC program is to define goals for the level of QA effort; accuracy, precision, and sensitivity of analyses; and completeness, representativeness, and comparability of measurement data from the toxicity testing laboratory.

Quality Assurance (QA) and Quality Control (QC) practices for effluent toxicity tests include aspects of the test that affect the accuracy and precision of the data, including (1) sampling handling and storage, (2) laboratory conditions, (3) test organisms, (4) reference toxicants, and (5) record keeping and data evaluation. Below is a summary of our quality objectives and standard QA/QC practices related to the conduct of our ecotoxicity tests.

Quality Objectives

- To ensure a Quality System that is documented and incorporates adequate review and internal quality control.
- To ensure personnel are adequately supervised and are proficient to carry out assigned activities.
- To ensure test methods and related procedures are validated and incorporate adequate quality control.
- To ensure all equipment, supplies and services are functioning properly and/or meet required specifications.
- To ensure that facilities are adequate to carry out the testing activity.
- To ensure sample management procedures that incorporate adequate procedures for the security, receipt, identification, checking, routing, storage and disposal of all samples.
- To ensure data management procedures that incorporate adequate procedures for the security, recording, calculation, validation, authorization, transmittal, storage and disposal of all test data and related records.
- To ensure workload management procedures that incorporate acceptable turnaround time and verification of resource availability prior to the acceptance of additional testing.

QA/QC Data Related to Individual Toxicity Tests

Test Validity Criteria:

- A test will be considered valid if the test validity criteria stated in the test method are met. Otherwise the test should be repeated.

Reference Toxicant Testing:

- A reference toxicant test will be conducted on the same batch of organisms used for conducting the definitive test.
- Each reference toxicant test will be conducted following the same procedures and conditions used for the test substance(s) although may involve a reduced duration of exposure.

Use of Warning Chart:

- A warning chart will be made available when testing involves test organisms are cultured or tested by AquaTox on a regular basis.

A test result is suspect if it falls outside the warning limits. In this event, a thorough check of the testing conditions is conducted at this time.