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## **APPENDIX D**

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### **DRAFT DFO Fish Habitat Authorization Permit**





## **AUTHORIZATION FOR WORKS OR UNDERTAKINGS AFFECTING FISH HABITAT**

### **AUTHORISATION POUR DES OUVRAGES OU ENTREPRISES MODIFIANT L'HABITAT DU POISSON**

**DFO File No. 02-HCAA-000-000063**  
Authorization No./N° de l'autorisation

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#### **Authorization Issued To/Autorisation délivrée à**

**Name:** Bruce Donald

**Address:** Teck Cominco Ltd.  
Teck Cominco Ltd., Polaris Operations  
Box 188  
Resolute Bay, Nunavut  
Canada X0A 0E0

**Telephone:** (867) 253-2201

**Facsimile:** (867) 253- 6862

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#### **Location of Project/Emplacement du projet**

Polaris Mine is located on Little Cornwallis Island (centred at 391500 E, 8 369 000 degrees N UTM zone 15) in the Qikiqtalluk Region of Nunavut (approximately 100 km northwest of Resolute Bay). The project site encompasses fish habitat at Garrow Lake, Garrow Creek, and Crozier Strait.

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#### **Valid Authorization Period/Période de validité**

**From/De:** November 1, 2002

**To/À:** October 30th , 2004

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#### **Description of HADD Works or Undertakings/Description des ouvrages ou entreprises**

In order to decommission Teck Cominco's (TCL) Polaris Mine, draining of water from the surface layer of Garrow Lake (the mine's tailings facility) and partial removal of Garrow Lake Dam will be required. This will result in the harmful alteration, disruption and/or destruction of fish habitat (HADD) due to lowering of the level of the lake and excavation of benthic fish habitat adjacent to the dam. Partial removal of a sheet-pile dock on Crozier Strait, and excavation to contour the adjacent marine foreshore area will also temporarily alter fish habitat during construction. The above works will hereafter be referred to as the "Project Activities".

#### **Summary of Habitat Loss**



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- Lowering the lake level of Garrow Lake and removal of the Garrow Lake Dam will dewater approximately 30 ha. of fish habitat. Garrow Lake has been documented to be habitat for fourhorn sculpin (*Myoxocephalus quadricornus*) and has the potential to provide habitat for other fish species. Garrow Lake drains into Garrow Bay via Garrow Creek and provides supporting habitat for other fish species in Crozier Strait.
- Partial removal of the dock and excavation of the marine foreshore area at Polaris will alter 2512 m<sup>2</sup> of fish habitat. The marine foreshore area at Polaris is habitat for arctic charr, arctic cod, and marine mammals (e.g., narwhal, ringed seals, walrus).

#### Conditions of Authorization/Conditions de l'autorisation

1.0 All works and undertakings shall be undertaken in accordance with the documents approved by DFO entitled:

1.1 Application for Authorization for Works or Undertakings Affecting Fish Habitat submitted to DFO, dated October 5<sup>th</sup>, 2001 and signed by Bruce Donald, TCL.

1.2 The approved documents include the works or undertakings, proposed mitigative measures and compensation requirements (the *Project Plan*).

2.0 To compensate for the harmful alteration, disruption or destruction of fish habitat as a result of the Project Activities, the following shall be implemented, maintained and monitored by TCL, as indicated in the *Project Plan* or otherwise specified by DFO:

2.1 To rehabilitate and enhance fish habitat in Garrow Lake, upon completion of water withdrawal and dam removal, TCL shall conduct the following as indicated in the *Project Plan*:

- 2.1.1 Restore a natural stream channel to Garrow Bay by removing at least 19,000 cubic metres of dam fill material. The constructed 500 m long by 15 metre wide stream channel through the decommissioned dam will emulate natural stream conditions with a gravel/cobble streambed. Enhancement efforts will result in the banks of the remaining dam having a slope of at least 4:1.
- 2.1.2 The enhanced stream channel draining Garrow Lake will be on average 11 m wide and restore natural drainage patterns in the Garrow Lake area. Clean rock rip-rap will be placed to prevent erosion in the vicinity of the decommissioned dam:



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A Fish Habitat Monitoring Report shall be submitted to DFO, including detailed photographs of Garrow Lake, stream channel development, prior to completion of the work. The intent of this Monitoring Report shall be to assess the success of fish habitat compensation upon implementation.

2.2 To rehabilitate and enhance fish habitat in the area of the dock and marine foreshore area, TCL shall conduct the following as indicated in the *Project Plan*:

- 2.2.1 Partial removal of the dock pilings to a depth of 3m below the low tide water level will develop natural inter-tidal conditions with slope and substrate adequate to control erosion into Crozier Strait.
- 2.2.2 Excavation of the inter-tidal shoreline adjacent to the dock to develop 12,800 m<sup>2</sup> of marine nearshore habitat with a slope of less than 17.5:1 to prevent erosion.
- 2.2.3 A Fish Habitat Monitoring Report shall be submitted to DFO, including detailed photographs of the marine foreshore area adjacent to the dock. Underwater photographs or video footage of the dock will be provided to DFO. The intent of this Monitoring Report shall be to assess the success of fish habitat compensation upon implementation.

3.1 The following mitigation measures are intended to minimize or prevent further harmful alteration, disruption or destruction of fish habitat adjacent to Garrow Lake and Garrow Creek:

- 3.1.1 Excavation of the dam will be conducted prior to spring break-up in 2004 and all silt and loose fines shall be removed from the construction area prior to spring break-up.
- 3.1.2 Rock rip-rap will be placed on the banks of the stream channel adjacent to the dam to prevent erosion and sedimentation.
- 3.1.3 Appropriate mitigation measures will be implemented to control TSS, including the construction of a dam at the discharge of Garrow Lake, if water quality deteriorates due to release of sediment. Other contingencies may be required as mitigation measures to protect fish habitat such as silt fences.

3.2 Appropriate mitigation measures will be implemented in the marine foreshore area, at and adjacent to the dock, as follows:

- 3.2.1 To minimize erosion in the marine foreshore area mitigation measures will be implemented to prevent deposition of sediment into the marine waters by use of silt fences and a floating silt curtain along the perimeter of the marine foreshore area if this is deemed necessary.
- 3.2.2 Water quality sampling for turbidity will be conducted daily during work and mitigation measures will be implemented to address potential sediment release.



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4.0 Monitoring will be conducted to ensure that compensation measures are successfully implemented and identify potential long-term project effects:

- 4.1 Sampling of TSS and turbidity will be undertaken by TCL in different strata of Garrow Lake to monitor stability of the halocline and to confirm the absence of contaminants in the upper strata of the lake.
- 4.2 A study of the metal concentrations in sediments adjacent to the shore of Garrow Lake, Garrow Creek, and the centre of Garrow Bay will be commissioned by TCL. TCL will provide a study design prior to April 2003 for approval by DFO.
- 4.3 TCL will conduct a study of fourhorn sculpins in Garrow Lake and Garrow Bay to examine metal levels in fish muscle tissue. A study design will be proposed by TCL to collect fish tissue samples for analysis by DFO. TCL will propose a sampling protocol for this study prior to April 2003.
- 4.4 Erosion will be monitored on the shore of Garrow Lake and Garrow Creek Stream channel. The study objective will be to quantify erosion rates adjacent to the lake and stream channel. This study will be proposed by TCL for DFO approval prior to April 2003.
- 4.5 TCL will conduct water quality sampling for TSS and turbidity at the Garrow Lake outflow in Garrow Creek. TCL will provide a Water Quality Sampling Report of TSS levels to the DFO Eastern Arctic Office on an annual basis for the duration of this authorization. Water quality sampling for TSS will not cease at the Garrow Lake outflow prior to 2004.
- 4.6 TCL will conduct water quality sampling for TSS and turbidity along the marine foreshore area prior to, during, and immediately following work in the inter-tidal zone. At least seven water quality samples will be routinely collected on a daily basis in the marine foreshore area during work in the inter-tidal zone. Two water quality samples per day will be collected adjacent to the dock.

5.0 A DFO Fishery Officer shall be notified at the Iqaluit Office ((867) 979-8000) of the proposed start time prior to commencement of the work.

6.0 Any deviation from the *Project Plan*, the construction schedule or the mitigation and compensation measures stated above that may potentially affect fish or fish habitat, must be discussed and approved in writing by DFO prior to implementation.

7.0 A copy of this Authorization shall be at the Polaris work site during all work periods. Work crews shall be made familiar with the conditions of this Authorization prior to implementation of the works or undertakings.



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The holder of this Authorization is hereby authorized under the authority of subsection 35(2) of the *Fisheries Act*, R.S.C., 1985, c. F. 14, to carry out the work or undertaking described herein. This Authorization is valid only with respect to fish habitat and for no other purposes. It does not purport to release the applicant from any obligation to obtain permission from or to comply with the requirements of any other regulatory agencies.

Failure to comply with any condition of this Authorization may result in charges being laid under the *Fisheries Act*.

This Authorization form should be held on site and work crews should be made familiar with the terms and conditions of this authorization.

Le détenteur de la présente est autorisé en vertu du paragraphe 35(2) de la *Loi sur les pêches*, L.R.C. 1985, ch. F. 14, à exploiter les ouvrages ou entreprises décrits aux présentes.

L'autorisation n'est valide qu'en ce qui concerne l'habitat du poisson et pour aucune autre fin. Elle ne dispense pas le requérant de l'obligation d'obtenir la permission d'autres organismes réglementaires concernés ou de se conformer à leurs exigences.

En vertu de la *Loi sur les pêches*, des accusations pourront être portées contre ceux qui ne respectent pas les conditions prévues dans la présente autorisation.

Cette autorisation doit être conservée sur les lieux des travaux, et les équipes de travail devraient en connaître les conditions.

Date of Issuance: Following NIRB Environmental Assessment

Signed by:

Prepared by:

Burt Hunt  
Area Director  
Eastern Arctic Area  
Fisheries and Oceans Canada  
Central and Arctic Region

Jordan DeGroot  
Habitat Management Biologist  
Fish Habitat Management  
Eastern Arctic Area  
Fisheries and Oceans Canada



Fisheries  
and Oceans

Pêches  
et Océans

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Authorization No. N° de l'autorisation

Bruce Donald- Reclamation Manager, Environment and Corporate Affairs

Witness:

Teck Cominco Ltd.

Teck Cominco Ltd.

Signature:

Signature:

Copy signed by TCL received by DFO

Signature:

Date:

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## **APPENDIX E**

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### **ALS Environmental Quality Management Program**







## **ALS Environmental (Canada) Quality Management System**

Last Updated: 2002 September 11

### **ALS CANADA LTD.**

1988 Triumph Street, Vancouver, BC Canada V5L 1K5  
Phone: 604-253-4188 Toll Free: 1-800-665-0243 Fax: 604-253-6700

Website: [www.alsenviro.com](http://www.alsenviro.com)

#2 -21 Highfield Circle SE, Calgary, AB Canada T2G 5N6  
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## TABLE OF CONTENTS

1.0	INTRODUCTION .....	1
2.0	THE HUMAN ELEMENT .....	2
2.1	Client Communication .....	2
2.2	Professional Judgement.....	2
2.3	Professional Qualifications .....	2
2.4	Quality Manager .....	3
2.5	Research and Development / Technical Coordinators.....	3
2.6	Staff Training.....	3
3.0	QUALITY ASSURANCE PROGRAM.....	4
3.1	Documentation.....	4
3.2	Accreditation .....	4
3.3	Proficiency Testing and Internal Audits.....	5
3.4	Quality Control .....	6
3.5	Data Quality Objectives .....	7
3.6	Reporting Quality Control Samples.....	8
4.0	REFERENCES .....	8

## ALS ENVIRONMENTAL'S QUALITY MANAGEMENT SYSTEM

### 1.0 INTRODUCTION

ALS Environmental's goal is to produce accurate analytical data that allow clients to make critical decisions with a high degree of confidence in the data quality. This goal is achieved by focussing on two key areas:

1. The judgement of experienced professionals who oversee each step in the analytical, quality control, and quality assurance processes - 46% of all staff have been at ALS Environmental (Canada) for more than five years, and 85% of staff have university degrees or diplomas.
2. A quality assurance program that provides protocols and procedures for generating reliable data supported by extensive documentation and quality control samples.

ALS Environmental's commitment to quality is reflected in the ideas expressed by Taylor [1]:

*"Quality assurance is more than a program; it is philosophy, a way of life. As a program that is mechanically followed, quality assurance is doomed to failure. As a philosophy, there is a chance for success. When it is approached as both a program and a philosophy, the chances for producing high quality data are excellent."*

ALS Environmental's quality management system ensures technically-sound data, and provides proof that sound work was done. A quality product is achieved when dedicated effort, attention to detail, and a comprehensive quality assurance program are combined with a desire for excellence by all staff and a workplace environment that promotes a culture of quality.

ALS Environmental commits significant human resources toward maintaining and improving our quality management system. This is a factor in the cost of analysing samples.



**Figure 1:** Elements of ALS Environmental's Quality Management System

## **2.0 THE HUMAN ELEMENT**

### **2.1 Client Communication**

Communication with clients combined with the professional judgement of our staff are important elements of ALS Environmental's quality management system (Figure 1). ALS Environmental is most likely to exceed clients' expectations when we are a part of the project technical team, and fully understand the analytical requirements. Automated equipment and standard operating procedures cannot substitute for professional judgement when dealing with complex samples and testing requirements.

Prompt resolution of data quality issues is a hallmark of a good laboratory. If an issue arises, a staff member is assigned to lead the process, and is given responsibility for resolving the issue to the client's satisfaction. We use a formal process to uncover and permanently correct the root cause, and to document corrective actions.

### **2.2 Professional Judgement**

Project Chemists, Analysts, Supervisors, Log-in Staff, and others who deal with samples and results, ensure high quality data by:

- Working with clients to determine their technical requirements, and to anticipate factors that could affect accuracy.
- Acting as the "custodian" of samples as they proceed through the analytical process (Project Chemists can immediately change the process if the specifications change).
- Recognizing unusual samples and difficult matrices before or during analysis and taking appropriate steps to overcome interferences.
- Reviewing data before release for scientific validity and, if needed, initiating rechecks.
- Assisting clients with interpretation of data, and reporting results in the best format for the client's needs.

### **2.3 Professional Qualifications**

ALS Environmental has made the decision to employ well-qualified, technically-trained staff at all levels of the company - 84% of staff have completed technical degrees or diplomas.

- The Executive and Managers promote and support the "quality culture" from the top down. They have an average of 18 years experience in environmental chemistry.
- Project Chemists are selected from within the group of analysts. They have university degrees and have worked at ALS Environmental for an average of nine years. They undergo training in all areas of the laboratory before starting to work with clients.

- Laboratory Supervisors and Analysts have university degrees (74%) or technical diplomas (16%). They have worked at ALS Environmental for an average of four years. About 18% have worked at ALS Environmental for more than 10 years. They are responsible for the day-to-day analysis of samples
- Sample preparation is done by technically-trained staff.
- Staff with technical backgrounds are part of the team that receive and login samples

## 2.4 *Quality Manager*

**Blair Easton**, Quality Manager, has more than 12 years experience in environmental chemistry, and has worked at ALS Environmental since 1990. He has successfully completed the International Register of Certified Auditors (IRCA) certified ISO 9000:2000 Series Auditor / Lead Auditor Training Course (Course No. A17020). As Quality Manager he is responsible for all aspects related to the ALS Environmental (Canada) Quality Management System.

## 2.5 *Research and Development / Technical Coordinators*

ALS Environmental's (Canada) Research and Development Group, led by **David Herbert, PhD**, and the Technical Coordinators review test methods. Method development and validation is an ongoing activity at ALS Environmental. Advances in analytical instrumentation and techniques are examined and new methods developed if the outcome is superior. Existing methods, including those mandated by regulatory requirements, are reviewed to ensure that ALS Environmental is doing the analysis using the most cost-effective techniques while still achieving accurate, precise data.

## 2.6 *Staff Training*

Staff training is a high priority at ALS Environmental. The increasing complexity of equipment, and samples requiring multi-component analyses, demands an ongoing commitment to training. ALS Environmental has established a core training program for all levels of staff. A few elements of our training program are:

- Proficiency testing of staff.
- Ensuring the trainers are trained.
- Rotation of employees to other departments.
- Internal and external technical courses.
- Management training.
- Emphasis on quality assurance and control as integral components of training programs.

### 3.0 QUALITY ASSURANCE PROGRAM

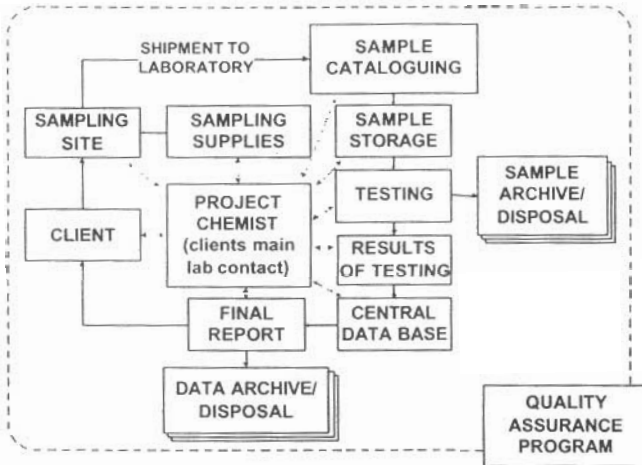


Figure 2: Schematic of Work Flow

Quality assurance is the comprehensive program for assuring reliability of analytical data. ALS Environmental's program is an ongoing process that keeps building onto existing activities to provide continuous improvement. It is a cyclical process of planning, implementing, checking and improving.

The Quality Assurance Program guides the flow of samples and results from the time samples arrive at ALS Environmental until the final report is issued (Figure 2).

### 3.1 Documentation

The basic building block of a Quality Assurance Program is documented policies, procedures and methods (Figure 3). Documentation eliminates inconsistencies that are inherent in working by memory, and provides specific details of what was done.

ALS Environmental's Good Laboratory Practices manual is the guiding quality assurance document. A copy is available on request.

Guiding Principles Documents, Standard Operating Procedures, Specific Procedures, and Specific Methodologies, contain proprietary information about how ALS Environmental carries out each procedure and analytical method. They are available for review at ALS Environmental.

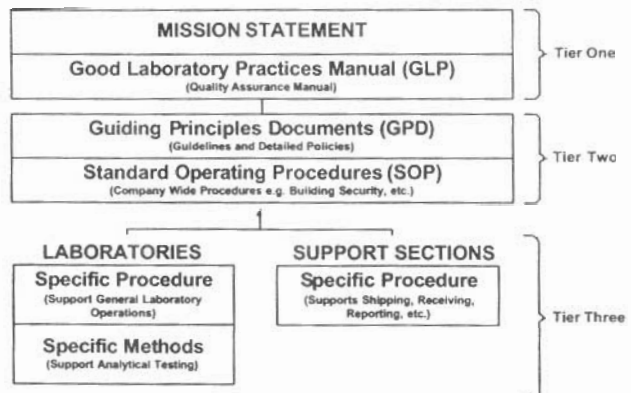


Figure 3: ALS Environmental Document Summary

### 3.2 Accreditation

Accreditation is a process that ensures laboratories meet a performance benchmark. ALS Environmental believes that consistent production of accurate data every day with different types of samples requires operating at a higher level than this benchmark.

All ALS Environmental (Canada) facilities ensure they obtain and maintain the recognition

conferred by the granting of laboratory certification by the Canadian Association for Environmental Analytical Laboratories (CAEAL) Inc. and accreditation by the Standards Council of Canada (SCC). Under this jointly administered program, CAEAL conducts site audits and evaluates each laboratory's performance at regular intervals, and SCC grants accreditation to the laboratory on CAEAL's recommendation. Current copies of ALS Environmental's Scopes of accreditation can be found at [http://www.scc.ca/accreditation/palcan/laboratories\\_e.html](http://www.scc.ca/accreditation/palcan/laboratories_e.html) or upon request from ALS Environmental (Canada).

Participating laboratories are assessed in accordance with ISO standards, an internationally recognized program of quality management. To attain SCC/CAEAL accreditation, each laboratory must comply with Canada's National Standard, called the General Requirements for the Competence of Testing and Calibration Laboratories (CAN-P-4D), which has been taken verbatim from ISO 17025-1999 and addresses specific management and technical aspects related to testing and calibration laboratories.

Laboratories are evaluated through inter-lab comparisons twice a year (some comparisons are performed four times annually) for which they are certified by CAEAL. Accreditation by SCC requires the laboratory to be CAEAL certified and to successfully complete a site audit every two years. Each laboratory must undertake any corrective actions within a specified period of time and to the satisfaction of a scientific panel (CAEAL, 1995). Site evaluation reports are available for review at ALS Environmental.

**State of Washington Department of Ecology (WA DOE)** - ALS Environmental (Vancouver) is accredited for inorganic, organic, and bacteriological parameters in water supplies. Our complete scope of accreditation is available on request.

**BC Ministry of Water, Land and Air Protection (BC WLAP)** - ALS Environmental (Vancouver) is registered under the Environmental Data Quality Assurance (EDQA) Regulation.

**BC Provincial Health Officer** - ALS Environmental (Vancouver) is approved to operate as a microbiology laboratory for testing drinking water.

### 3.3 Proficiency Testing and Internal Audits

The CAEAL proficiency testing program for specific tests or types of tests determines the ability of ALS Environmental to produce accurate results. Inter-laboratory comparisons are done twice a year for the tests accredited by CAEAL.

IN 1997, CAEAL compared the performance of accredited and non-accredited laboratories on five tests: biochemical oxygen demand (BOD); total suspended solids (TSS); chloride (CL); dissolved iron (DFE); and fecal coliforms (FCOL). Mean



**Figure 4:** Mean Scores (%) on Selected Proficiency Tests

scores and the ALS Environmental (Vancouver), formally ASL Analytical Services Laboratories (ASL), scores are shown in Figure 4 [2].

ALS Environmental also participates in numerous other check study programs (round-robins). This enables ALS Environmental to evaluate testing performance on a wide range of parameters in various types of samples. These check samples are often "real" samples without known "target values". A summary of ALS Environmental's inter-laboratory check programs and certification studies is available on request.

Internal audits of compliance with procedures and policies are conducted on a regular schedule. These audits are an integral part of the continuous improvement cycle.

### 3.4 Quality Control

Quality Control (QC) is the technical activities used to assess and control the quality of the measurement process. At ALS Environmental, ~25% of samples analyzed are for method quality control. The number of blanks, spikes, replicates, and standards per batch is specific to the type and nature of the test. Details are given in Specific Method documents which are available for review at ALS Environmental.

QC samples allow determination of precision and accuracy of analytical procedures, and examine possible contamination during the entire sampling and analysis process for batches of samples. QC samples can be internal samples prepared in the laboratory, samples obtained from external sources, and field samples which are project specific. Table 1 summarizes types of QC samples.

Table 1: Definitions of Laboratory and Field QC Samples		
QC Sample	Definition	Purpose
<u>Laboratory</u> Method	Clean sample matrix which undergoes processing identical to that carried out on the samples	<ul style="list-style-type: none"><li>Assesses method contamination control;</li><li>Assesses method sensitivity when replicated.</li></ul>
Reference Material	A material or substance, one or more properties of which are sufficiently well established for it to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials.	<ul style="list-style-type: none"><li>Method accuracy on samples of known characteristics;</li><li>Mean method accuracy and method precision on samples of known characteristics when replicated.</li></ul>
Method Analyte Spike	Sample, clean matrix, or reagents which are fortified with a known quantity of the analyte(s) of interest prior to undergoing sample processing identical to that carried out on the samples.	<ul style="list-style-type: none"><li>Method accuracy on samples of known standard additions;</li><li>Mean method accuracy and method precision on samples of known standard additions when replicated.</li></ul>
Sample Split	Two or more independently sub-sampled portions of the same homogenized sample, separately prepared and processed by the identical method.	<ul style="list-style-type: none"><li>Sub-sampling precision on samples of unknown characteristics.</li></ul>



Table 1: Definitions of Laboratory and Field QC Samples		
QC Sample	Definition	Purpose
Surrogate Compound Spike	Check standards added to every sample (where applicable) in known amounts at the beginning of an analysis; they are not one of the target analytes and are not expected to be found in the samples. Surrogate compounds should be chemically similar to the analyte(s) of interest.	<ul style="list-style-type: none"> <li>Method accuracy on samples of known surrogate addition.</li> </ul>
<u>Field</u> Transportation Blank	A sample container that contains clean matrix (typically distilled - de-ionized water) which accompanies the sample containers from the laboratory into the field and which returns to the laboratory unopened.	<ul style="list-style-type: none"> <li>Assesses contamination control through the total assay;</li> <li>Assesses total assay sensitivity when replicated.</li> </ul>
Field Blank	Clean matrix (typically distilled - de-ionized water) which is exposed to the same conditions as the sample. The field blank accompanies the sample from the field to the laboratory.	<ul style="list-style-type: none"> <li>Assesses contamination control from sampling through laboratory processing.</li> </ul>
Field Analyte Spike	Sample or clean matrix which are fortified with a known quantity of the analyte(s) of interest prior to shipment to the laboratory.	<ul style="list-style-type: none"> <li>Total assay accuracy on samples of known standard additions;</li> <li>Mean total assay accuracy and assay precision on samples of known standard additions when replicated.</li> </ul>
Field Split	Two or more independently sub-sampled portions of the same homogenized sample, separately prepared prior to shipment to the laboratory.	<ul style="list-style-type: none"> <li>Field sub-sampling precision on samples of unknown characteristics.</li> </ul>
Field Replicate	Two or more independent grab samples taken from the same sample location.	<ul style="list-style-type: none"> <li>Temporal and/or spatial sampling variations.</li> </ul>

### 3.5 Data Quality Objectives

ALS Environmental has established data quality objectives (DQO's) for analytical parameters. The DQO's depend on the type of test and the nature of the sample, taking into account factors such as the homogeneity of solid samples. Figure 5 illustrates a performance control chart which shows control and warning limits for a specific test, and sample results. Performance charts help to determine trends in analytical data, and to flag data that are outside the DQO's. Tables of ALS Environmental's DQO's are available upon request.

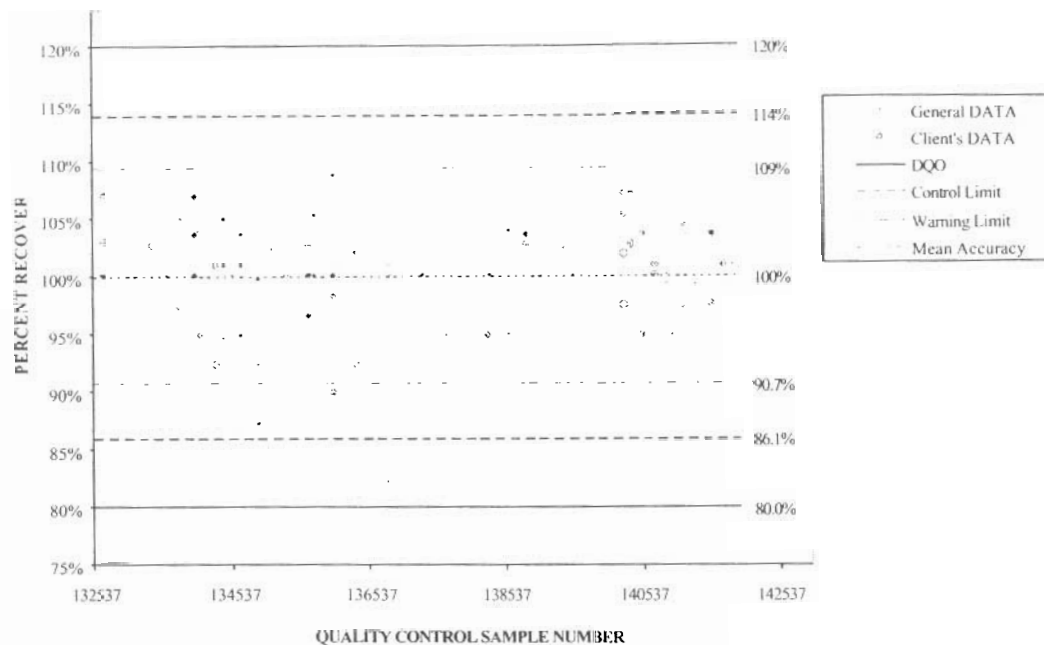


Figure 5: Example of a Performance Control Chart

### 3.6 Reporting Quality Control Samples

Reports of quality control data may be requested or required. ALS Environmental can report any of the parameters listed in Table 1. The best approach is to review with us project specific requirements before starting the analytical work, and to develop an appropriate quality control report.

All results and quality control data generated by ALS Environmental are stored in our Laboratory Information Management System (LIMS). All database software is written by ALS Environmental's systems programmers. All data are backed-up daily to tape.

## 4.0 REFERENCES

1. Taylor, John Keenan. "Quality Assurance of Chemical Measurements". Lewis Publishers, Inc., 1987, page 5.
2. The document "Laboratory Accreditation: Proof of Performance" is available on the CAEAL web site - [www.caeal.ca/perfared.html](http://www.caeal.ca/perfared.html)