



Quality Assurance Assessment Tools to Assist Project Data Quality Review & Reporting

Important decisions based on laboratory test results can only occur when stakeholders have confidence and context in the quality of the entire testing process, including holding time conformance; ALS provides a comprehensive Quality Control Interpretive (QCI) report by confirming whether or not all the crucial Quality Control and Quality Assurance elements of testing were met.

The ALS interpretive report is 100% automated (report untouched by human hand) and provides an instant assessment of quality data to save industry experts time and rapidly advise of any non-conformances which could impact project decisions.

Common Quality Control Sample Types

Quality Control (QC) is a crucial component in providing reliable and defensible data. Quality Control is implemented in our laboratories by utilizing appropriate industry-standard QC sample types, which demonstrate control of laboratory processes and confirm that tests are performing as expected. QC samples are introduced at critical points of sample handling, preparation, and analysis.

Instrument QC (e.g. calibration checks) demonstrates control of the instrumental portion of a method. Instrument QC requirements must be successfully met before the analysis of Method QC or client samples may proceed.

Method QC encompasses the entire test method, including all sample preparation and instrumental analysis factors. Appropriate Method QC depends on the type of test, but often includes Method Blanks, Duplicates, Laboratory Control Samples, Matrix Spikes, Surrogates, and Reference Materials. The results and evaluation of Method QC samples are important to verify the quality of sample test results.

Table 1. Common Quality Control Types

QC Type	Definition and Purpose
Method Blank	A blank matrix that has gone through the same analysis steps as samples, used to monitor variability of the blank response, contamination, and bias.
Duplicate	A second aliquot of sample analyzed independently from the primary test sample. Assesses variance (precision) of the total method including lab sub-sampling and analysis.
Laboratory Control Samples	A clean matrix that has been fortified with a known amount of target analyte, used to verify the accuracy of the test method.
Matrix Spike	An aliquot of client sample fortified with a known amount of target analyte, used to identify matrix interference effects on method recovery.
Surrogate	An organic compound with similar chemical composition and properties to the target analyte(s), used to monitor analyte recovery / extraction efficiency in each sample. Commonly used in organics testing.
Reference Material	A material or substance with homogenous and well-established properties, used to assess the performance of a measurement method.

Data Quality Objectives

ALS Data Quality Objectives (DQOs) are the performance specifications that define QC control limits. DQOs are established for each QC type, based on a combination of reference method objectives, customer requirements, and historical test method performance.

Holding Times and Causes of Analyte Change

Another key element of data quality for the evaluation of laboratory test results is consideration of holding times. Holding times are the maximum recommended elapsed time between sample collection and commencement of preparation or analysis, as appropriate. Holding times are based upon published reference methods, industry standards, and provincial requirements. Meeting holding times is important to ensure that measured analyte concentrations accurately reflect the condition of the sample at time of collection. Please refer to the [Sample Collection Pocket Guide](#) for holding times applicable to most common ALS tests.

There are many reasons why parameter concentrations within environmental samples can change over time after sampling, even where appropriate preservation techniques can be applied. Some common reasons follow, including whether a negative or positive bias may occur:

- Bacterial degradation (e.g. ammonia → nitrite → nitrate; negative or positive bias)
- Oxidation or photodegradation (negative or positive bias)
- Metals precipitation or adsorption to bottles (negative bias)
- Microbial morbidity or continued growth (false negative or positive)

While exceeding holding times does not necessarily mean results are no longer valid, additional context and information about how exceedances may affect the samples is needed.

How ALS Assists in Project Data Quality Review

ALS provides important information to clients in the form of several reports designed to confirm whether project Data Quality Objectives have been achieved. Given the risk of negative and positive bias, it is crucial that samples are received with appropriate sample containers, preservation, temperature, and within applicable holding times. ALS provides an initial assessment of these factors at the time of sample receipt, which is reported to our clients through our Sample Receipt Notification (SRN) report as soon as sample reception and login is complete.

ALS also offers numerous other beneficial reports that provide information on the entire testing process, which helps to confirm data quality goals have been met. One powerful example is the ALS Quality Control Interpretive report, which delivers a full assessment of laboratory QC,

in addition to details on holding time compliance and QC frequency.

ALS Quality Control Interpretive Report

The ALS Quality Control Interpretive (QCI) report automatically generates an at-a-glance summary evaluation and interpretation of QC results and other critical quality elements associated with the testing process. This report highlights exceptions and outliers to ALS Data Quality Objectives, holding time compliance, QC sample frequencies, and lists important methodology references and summaries.

Data Quality Objective Compliance

It is ALS policy that all QC results should fall within control limits. If exceedances occur, appropriate action is taken within the lab, including reanalysis of client samples associated with outlying QC results. Sometimes this cannot be done due to insufficient remaining sample, in which case the associated test results are qualified with comments to provide context and information for how DQO exceedances may impact sample results. The Summary of Outliers section of the QCI report (Figure 1) indicates whether any DQO exceedances have occurred; if outliers exist, details are provided.



Figure 1: Summary of Outliers

Analysis Holding Time Compliance

The Holding Time compliance section of the QCI report summarizes details around commencement of analysis. It includes relevant dates of sampling and laboratory preparation and/or analysis. The hold time is calculated and an evaluation is presented. Where preparation and analysis were performed within holding times, this will be displayed as shown in the below example (Figure 2). If there are hold time exceedances, these will be indicated and additional comments will be provided.

Matrix: Water Evaluation: * = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group : Analytical Method Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Aggregate Organics : Chemical Oxygen Demand by Colourimetry (Low Level)										
Amber glass total (sulfuric acid) Client Sample	E559-L	15-Jan-2024	---	---	---		16-Jan-2024	28 days	1 day	✓
Aggregate Organics : Phenols (4AAP) in Water by Colourimetry										
Amber glass total (sulfuric acid) Client Sample	E562	15-Jan-2024	17-Jan-2024	28 days	2 days	✓	17-Jan-2024	28 days	2 days	✓

Figure 2: Analysis Holding Time compliance evaluation from QCI Report

QC Sample Frequency Compliance

QC samples are analyzed in analytical batches (QC lots) of client samples. The expected frequency of QC analysis is defined by each test method for each QC type. This section of the QCI report (Figure 3) indicates whether the expected frequency of each QC type was met. Where the actual frequency of QC is greater than or equal to the expected frequency, the evaluation will display a pass. If the frequency is lower, the evaluation will show it to be outside of the specification and additional comments will be provided to explain how this affects client sample results.

Matrix: Water Evaluation: * = QC frequency outside specification; ✓ = QC frequency within specification.

Quality Control Sample Type Analytical Methods	Method	QC Lot #	Count			Frequency (%)		
			QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)								
Chemical Oxygen Demand by Colourimetry (Low Level)	E559-L	1303951	1	8	12.5	5.0	✓	
Phenols (4AAP) in Water by Colourimetry	E562	1304976	1	20	5.0	5.0	✓	
Laboratory Control Samples (LCS)								
Chemical Oxygen Demand by Colourimetry (Low Level)	E559-L	1303951	1	8	12.5	5.0	✓	
Phenols (4AAP) in Water by Colourimetry	E562	1304976	1	20	5.0	5.0	✓	
Method Blanks (MB)								
Chemical Oxygen Demand by Colourimetry (Low Level)	E559-L	1303951	1	8	12.5	5.0	✓	
Phenols (4AAP) in Water by Colourimetry	E562	1304976	1	20	5.0	5.0	✓	
Matrix Spikes (MS)								
Chemical Oxygen Demand by Colourimetry (Low Level)	E559-L	1303951	1	8	12.5	5.0	✓	
Phenols (4AAP) in Water by Colourimetry	E562	1304976	1	20	5.0	5.0	✓	

Figure 3: QC Frequency compliance evaluation from QCI Report

Methodology References and Summaries

Analytical methods used by ALS are developed using nationally or internationally recognized reference methods, where available. The methodology section of the QCI report (Figure 4) outlines which analytical methods were used for analysis, including a general description of the test. Modifications to improve performance of the test are indicated with a note that the reference method has been modified where permitted, e.g., APHA 5220 D (mod). Modifications are fully validated and are intended to provide superior data quality.

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Chemical Oxygen Demand by Colourimetry (Low Level)	E559-L ALS Environmental - Vancouver	Water	APHA 5220 D (mod)	Samples are analyzed using the closed reflux colourimetric method.
Phenols (4AAP) in Water by Colourimetry	E562 ALS Environmental - Edmonton	Water	EPA 9066	This automated method is based on the distillation of phenol and subsequent reaction of the distillate with alkaline ferricyanide (K ₃ Fe(CN) ₆) and 4-amino-antipyrine (4-AAP) to form a red complex which is measured colourimetrically.

Figure 4: Methodology Summary from QCI Report

Other QC Report Options

ALS offers a wide array of reports designed to meet your project needs. The QCI report is just one such option, and is intended to make review of Holding Time and QC DQO compliance easy. Additional QC report types are also available, including a comprehensive QC Report and Excel Report. Both of these reports include all QC results associated with sample testing, where more complete information is needed.

Contact your ALS Project Manager to ensure your ALS projects are configured to provide the QC reports that best meet your needs.